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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WORK PLAN FOR SITES 5, 7, 29, 35, 38, 39, 40 AND PSC 1485C NAS WHITING FIELD FL

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TETRA TECH

Rev. 2
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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WORK PLAN FOR SITES 5, 7, 29, 35, 38, 39, 40, AND PSC 1485C

Naval Air Station
Whiting Field
Milton, Florida

Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order CTO 0079

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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WORK PLAN FOR SITES 5, 7, 29, 35, 38, 39, 40, AND PSC 1485C

NAVAL AIR STATION
WHITING FIELD
MILTON, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:

Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:

Tetra Tech NUS, Inc.
661 Andersen Drive
Foster Plaza
Pittsburgh, Pennsylvania 15220

CONTRACT NO. N62467-94-D-0888
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PREPARED UNDER THE SUPERVISION OF:	APPROVED FOR SUBMITTAL BY:
	Debra M Wroblewski
TERRY J. HANSEN	DEBBIE WROBLEWSKI
TASK ORDER MANAGER	PROGRAM MANAGER
TETRA TECH NUS, INC.	TETRA TECH NUS, INC.
TALLAHASSEE, FLORIDA	PITTSBURGH, PENNSYLVANIA

PROFESSIONAL GEOLOGIST CERTIFICATION

This document, *Remedial Investigation and Feasibility Study Work Plan for Sites 5, 7, 29, 35, 38, 39, 40, and PSC 1485C*, Naval Air Station Whiting Field, Milton, Florida, has been prepared under the direction of a Florida Registered Professional Geologist. The work and professional opinions rendered in this report were conducted or developed in accordance with commonly accepted procedures consistent with applicable standards of practice. This document was prepared for U.S. Naval Air Station Whiting Field, Milton, Florida, and should not be construed to apply to any other site.

Tetra Tech NUS, Inc.
1401 Oven Park Drive, Suite 102
Tallahassee, Florida 32312

Gerald A Walker

Gerald A. Walker
Professional Geologist
State of Florida License No. 1180

Date: 1/14/00

FOREWORD

To meet its mission objectives, the U.S. Navy performs a variety of operations, some requiring the use, handling, storage, or disposal of hazardous materials. Through accidental spills and leaks and conventional methods of past disposal, hazardous materials may have entered the environment. With growing knowledge of the long-term effects of hazardous materials on the environment, the U. S. Department of Defense initiated various programs to investigate and remediate conditions related to suspected past releases of hazardous materials at its facilities.

One of these programs is the Installation Restoration (IR) program. This program complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), the Resource Conservation and Recovery Act, and the Hazardous and Solid Waste Amendments of 1984. These acts establish the means to assess and clean up hazardous waste sites for both private-sector and federal facilities. The CERCLA and SARA acts form the basis for what is commonly known as the Superfund program.

Originally, the Navy's part of this program was called the Naval Assessment and Control of Installation Pollutants (NACIP) program. Early reports reflect the NACIP process and terminology. The Navy eventually adopted the program structure and terminology of the standard IR program.

The IR program consists of Preliminary Assessment (PA) and Site Inspections (SIs), Remedial Investigation (RI) and Feasibility Study (FS), and Remedial Design (RD) and Remedial Action (RA) at sites where chemicals were allegedly spilled or disposed of. The PA and SI identify the presence of pollutants. The nature and extent of contamination as well as the selected remedial solutions are determined during the RI/FS. The RD and RA are performed to complete implementation of the solution.

The investigative procedures, site assessment activities, and remedial alternative evaluations to be performed during RI/FS Work Plan activities at Sites 5, 7, 29, 35, 38, 39, 40, and PSC (Potential Source of Contamination) 1485C are discussed in this report.

The Southern Division, Naval Facilities Engineering Command manages and the U.S. Environmental Protection Agency and the Florida Department of Environmental Protection (formerly the Florida Department of Environmental Regulation) oversee the Navy environmental program at Naval Air Station (NAS) Whiting Field. All aspects of the program are conducted in compliance with state and federal regulations, as ensured by the participation of these regulatory agencies.

Questions regarding the CERCLA program at NAS Whiting Field should be addressed to Ms. Linda Martin, Code 1859, at (843) 820-5574.

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ACRONYMS AND ABBREVIATIONS

ABB-ES	ABB Environmental Services, Inc.
ARAR	applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
AVGAS	aviation gasoline
AWQC	Ambient Water Quality Criteria
BAF	Bioaccumulation Factor
BERA	Base Line Environmental Risk Assessment
bls	below land surface
BOS	Base Operating Services
BTEX	benzene, toluene, ethylbenzene, and xylenes
C°	Degrees Celcius
CCME	Canadian Council Ministry of Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
COC	chemical of concern
COMPQAP	Comprehensive Quality Assurance Plan
COPC	chemical of potential concern
cm/sec	centimers per second
CRQL	contract required detection limit
CSF	cancer slope factor
CSM	conceptual site model
C_w	Concentration of chemical in water
EE	Envirodyne Engineers
DA event	absorbed dose per event
DAD	dermally absorbed dose
DMS	database management system
DNAPL	dense, nonaqueous-phase liquid
DO	dissolved oxygen
DPT	direct-push technology
DQO	data quality objective

ACRONYMS AND ABBREVIATIONS (continued)

ELCR	excess lifetime cancer risk
EP Tox	Extraction Procedure Toxicity
EPC	exposure point concentration
ERA	ecological risk assessment
ER-L	effects range low
ERT	Emergency Response Team
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FFS	Focused Feasibility Study
FGFWFC	Florida Game and Fresh Water Fish Commision
FID	flame ionization detector
FNAI	Florida Natural Areas Inventory
FOL	Field Operations Leader
FR	Federal Register
FS	Feasibility Study
GAC	granular activated carbon
GC	gas chromatograph
GIR	General Information Report
GM	Geraghty and Miller
GPS	Global Positioning System
HEAST	Health Effects Assessment Summary Tables
HHCOPC	human health chemicals of potential concern
HHRA	human health risk assessment
HI	hazard index
HLA	Harding Lawson Associates
HQ	hazard quotient
HRS	Hazard Ranking System
HSA	hollow-stem auger
IAS	Initial Assessment Study
IDW	investigation-derived waste
IR	Installation Restoration
IRIS	Integrated Risk Information System
JP-5	Jet Propellant 5
Kg	Kilogram

ACRONYMS AND ABBREVIATIONS (continued)

LOAEL	lowest observed adverse effect level
MCL	Maximum Contaminant Level
ml	milliliter
mg/kg	milligrams per killgrams
mg/L	milligrams per liter
μg/L	micrograms per liter
MOE	Ministry of Environment
MSL	mean sea level
NACIP	Navy Assessment and Control of Installation Pollutants
NAPL	nonaqueous-phase liquid
NAS	Naval Air Station
Navy	U.S. Navy
NCP	National Oil and Hazardous Substances Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NFA	No Further Action
NFESC	Naval Facilities Engineering Service Center
NGVD	National Geodetic Vertical Datum
NIST	National Institute of Standards and Technology
NOAA	National Oceanographic and Atmospheric Administration
NOAEL	no observed adverse effect level
NPL	National Priorities List
NTU	Nephelometric Turbidity Unit
NWFWMD	Northwest Florida Water Management District
NWI	National Wetlands Iventory
OHA	Office of Health Assessment
OVA	organic vapor analyzer
PA	Preliminary Assessment
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	perchloroethene
PDWS	Primary Drinking Water Standards
PID	photo-ionization detector
POC	Point of Contact
ppm	parts per million

ACRONYMS AND ABBREVIATIONS (continued)

PPE	Personal Protective Equipment
PSC	Potential Source of Contamination
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RA	remedial action
RAGS	Risk Assessment Guidance for Superund
RAO	remedial action objective
RBC	risk-based concentration
RD	Remedial Design
Redox	oxidation-reduction
RfD	reference dose
RGO	remedial goal option
RI	Remedial Investigation
ROD	Record of Decision
RME	Reasonable Maximum Exposure
RTV	reference toxicity value
SACM	Superfund Accelerated Cleanup Model
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments Reauthorization Act of 1986
SDWS	Secondary Drinking Water Standards
SEL	Severe Effects Levels
SI	Site Inspection
SMDP	Scientific/Management Data Points
SOP	Standard Operating Procedure
SOUTHNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command
SOW	Scope of Work
SP	spontaneous potential
SPLP	synthetic precipitation leaching procedure
SQL	sample quantitation limit
SSL	soil screening level
SSI	Site Screening Investigation
SVE	soil vapor extraction

ACRONYMS AND ABBREVIATIONS (continued)

SVOC	semivolatile organic compound
TAL	target analyte list
TtNUS	Tetra Tech NUS, Inc.
TCA	trichloroethane
TCE	trichloroethene
TCL	target compound list
TCLP	Toxicity Characteristic Leaching Procedure
TEL	Threshold Exposure Limit
TPH	total petroleum hydrocarbons
TRAWING FIVE	Training Air Wing Five
TRPH	total recoverable petroleum hydrocarbons
TRV	Toxicity Refernence Value
UCL	upper confidence limit
UCL-N	normal upper confidence limit
USEPA	U.S. Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WHS	NAS Whiting Field
UST	underground storage tank
UV	ultraviolet
VOC	volatile organic compound

EXECUTIVE SUMMARY

The work to be performed for the Remedial Investigation and Feasibility Study at Sites 5, 7, 29, 35, 38, 39, 40, and PSC 1485C at Naval Air Station Whiting Field, Milton, Florida, are presented in this Work Plan. Remedial Investigation and Feasibility Study activities will be performed in accordance with this Work Plan as well as with Tetra Tech NUS, Inc. *Comprehensive Quality Assurance Plan* (Florida Department of Environmental Protection Comprehensive Quality Assurance Plan No. 980038) and with its 1999 *Site-Specific Health and Safety Plan.* This Remedial Investigation and Feasibility Study is being conducted by Southern Division, Naval Facilities Engineering Command as part of the U.S. Department of Defense Installation Restoration program.

The purpose of this Work Plan is to propose an investigation to further define the nature and extent of contamination at Sites 7, 29, 35, 39, 40, and to propose initial investigations of assessments at Sites 5 and 38 and PSC 1485C. The information generated from this investigation will be used as a basis for recommending remedial alternatives that address identifiable risks to public health and the environment. To achieve this objective, the Remedial Investigation will collect data sufficient to assess the nature and extent of contaminants and to evaluate remedial alternatives associated with each site. The Feasibility Study will use the data collected during the Remedial Investigation as well as data from previous investigations to evaluate and recommend remedial alternatives.

This Work Plan is intended to be a dynamic document that permits flexibility during implementation of the various investigations. Central to this work is an understanding that complete site characterization is often not economically feasible, or typically not necessary. Furthermore, investigators must recognize that uncertainties will remain that will have to be managed during the Remedial Investigation and Feasibility Study. By managing these uncertainties and moving forward to developing and implementing remedies, the overall Remedial Investigation and Feasibility Study process will be streamlined and shortened. Such streamlining was the U. S. Environmental Protection Agency's major objective in the development of the Superfund Accelerated Cleanup Model, which permits earlier initiation of remedies, thereby reducing existing risks to humans and the environment.

The Superfund Accelerated Cleanup Model process selects presumptive remedies that encourage earlier initiation of remedial activities and more focused investigations. The presumptive remedy approaches identified by the U.S. Environmental Protection Agency for Superfund sites with contaminated groundwater and volatile organic compounds in soil have been used to focus the collection of appropriate data during the field investigation. The overall objective of this Work Plan is to collect only those data required to further define the nature and extent of contamination and that are required to evaluate the remedial technologies applied to reach the remedial objectives. Additional data that will permit the evaluation of risks and exposures related to the application of the presumptive remedy will be acquired.

The field program proposed in this document and developed to achieve these goals will include the collection of soil, biota, surface water, sediment, and groundwater samples for analysis and data evaluation. It is anticipated that the resulting data will enable sufficient site characterization and risk evaluation for determination of the appropriate technologies to support the presumptive remedy for these sites.

1.0 INTRODUCTION

1.1 REGULATORY BACKGROUND

To meet its mission objectives, the U.S. Navy (Navy) performs a variety of operations, some requiring the use, handling, storage, or disposal of hazardous materials. Through accidental spills and leaks as well as through conventional past methods of disposal, hazardous materials may have entered the environment. With growing knowledge of the long-term effects of hazardous materials on the environment, the U.S. Department of Defense initiated various programs to investigate and remediate conditions related to suspected past releases of hazardous materials at its facilities. One of these programs is the Installation Restoration (IR) program.

Originally, the Navy's program was called the Navy Assessment and Control of Installation Pollutants (NACIP) program. Early reports reflect the NACIP process and terminology. The Navy eventually adopted the program structure and terminology of the standard IR program.

The IR program is conducted in several stages as follows:

1. Preliminary Assessment (PA).

2. Site Inspection (SI) [under the NACIP program, the PA and SI steps were called the Initial Assessment Study (IAS)].

3. Remedial Investigation (RI) and Feasibility Study (FS).

4. Remedial Design (RD) and Remedial Action (RA).

The Navy IR program was designed to identify and abate or control contaminant migration resulting from past operations at naval installations, with a goal of expediting and improving environmental response actions while protecting human health and the environment. The IR program is conducted in accordance with Section 120 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and Executive Order 12580. CERCLA requires federal facilities comply with the act, both procedurally and substantively. Southern Division Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) is the agency responsible for the Navy IR program in the southeastern

United States; therefore, SOUTHNAVFACENGCOM has the responsibility of processing Naval Air Station (NAS) Whiting Field through the PA, SI, RI/FS, and remedial response selection in compliance with the guidelines of the National Oil and Hazardous Substances Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) 300].

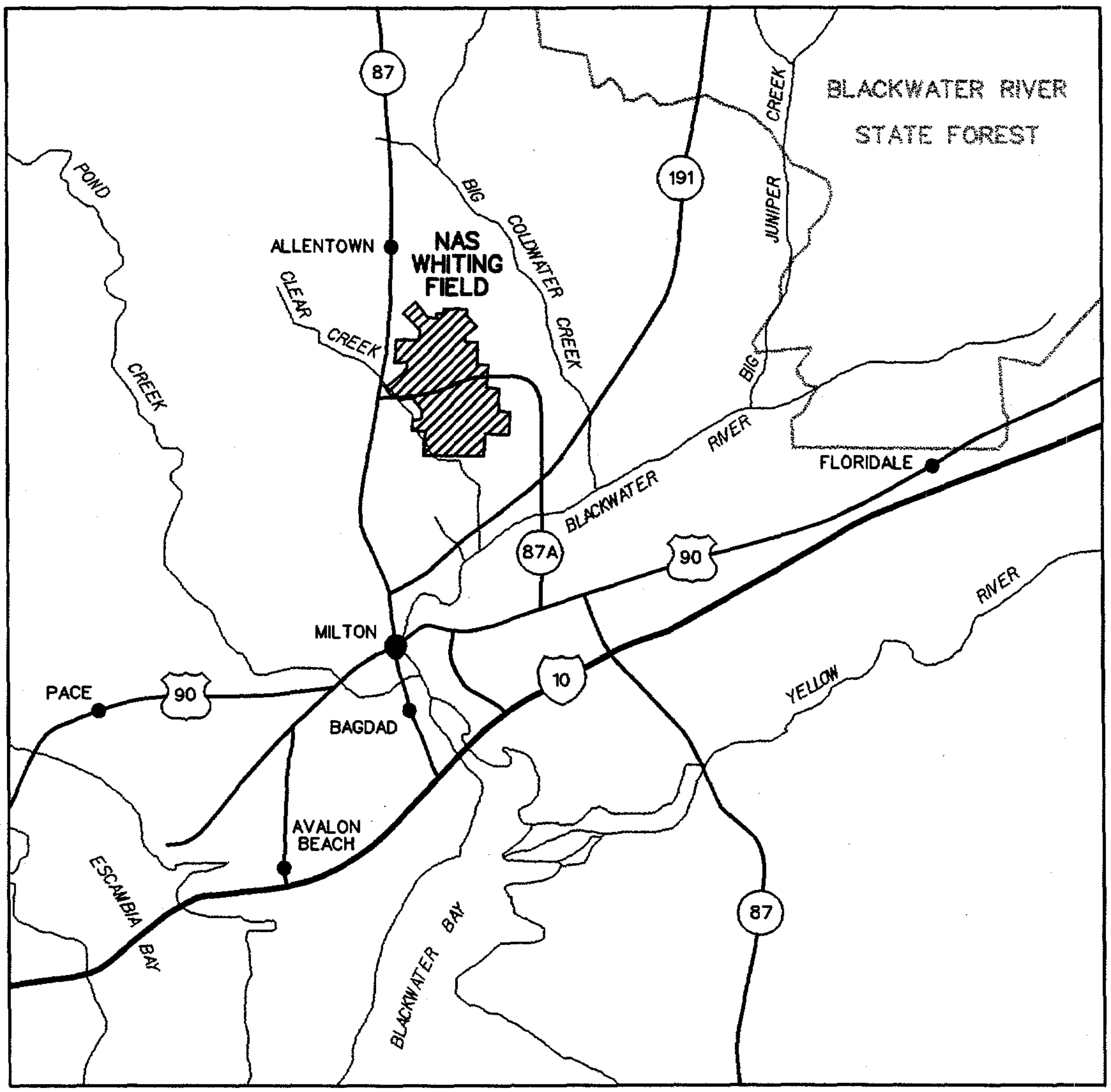
Section 105(a)(8)(A) of SARA required the U.S. Environmental Protection Agency (USEPA) to develop criteria to set priorities for remedial action based on relative risk to public health and the environment. To meet this requirement, USEPA has established the Hazard Ranking System (HRS) as Appendix A to the NCP. First promulgated in 1982, the HRS was amended in December 1990, effective March 14, 1991 [55 *Federal Register* (FR) No. 241:51532-51667], to comply with requirements of Section 105(c)(1) of SARA to increase the accuracy of the assessment of relative risk.

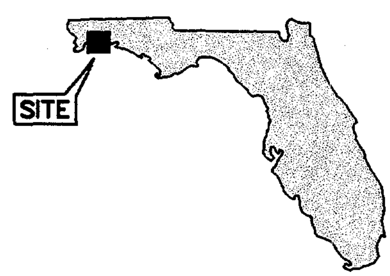
The HRS score for NAS Whiting Field was generated in 1993. The score was sufficient to place NAS Whiting Field on the National Priorities List (NPL); therefore, in January 1994, USEPA placed NAS Whiting Field on a list of sites proposed for inclusion on the NPL (40 CFR 300; FR 18 January 1994), and on May 31, 1994, NAS Whiting Field was placed on the NPL effective June 30, 1994 (40 CFR 300; FR 31 May 1994). As a result, the RI/FS for NAS Whiting Field must follow the requirements of the NCP, as amended by SARA, and guidance for conducting an RI/FS under CERCLA (USEPA 1988a).

1.2 FACILITY BACKGROUND

NAS Whiting Field is located in Santa Rosa County, in Florida's northwest coastal area, approximately 5.5 miles north of Milton and 25 miles northeast of Pensacola (Figure 1-1). NAS Whiting installation is approximately 3,842 acres in size, and consists of two airfields separated by an industrial area. Figure 1-2 presents the installation layout and the locations of the sites at NAS Whiting Field.

NAS Whiting Field, home of Training Air Wing Five (TRAWING FIVE), was constructed in the early 1940s. It was commissioned as the Naval Auxiliary Air Station Whiting Field in July 1943 and has served as a naval aviation training facility ever since its commissioning. The field's mission has been to train student naval aviators in the use of basic instruments; formation and tactic phases of fixed-wing, propeller-driven aircraft; and, basic and advanced helicopter operation.





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SCALE IN MILES

FIGURE 1-1

FACILITY LOCATION MAP

RI/FS WORK PLAN
SITES 5, 7, 29, 35, 38, 39, 40 AND
PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA

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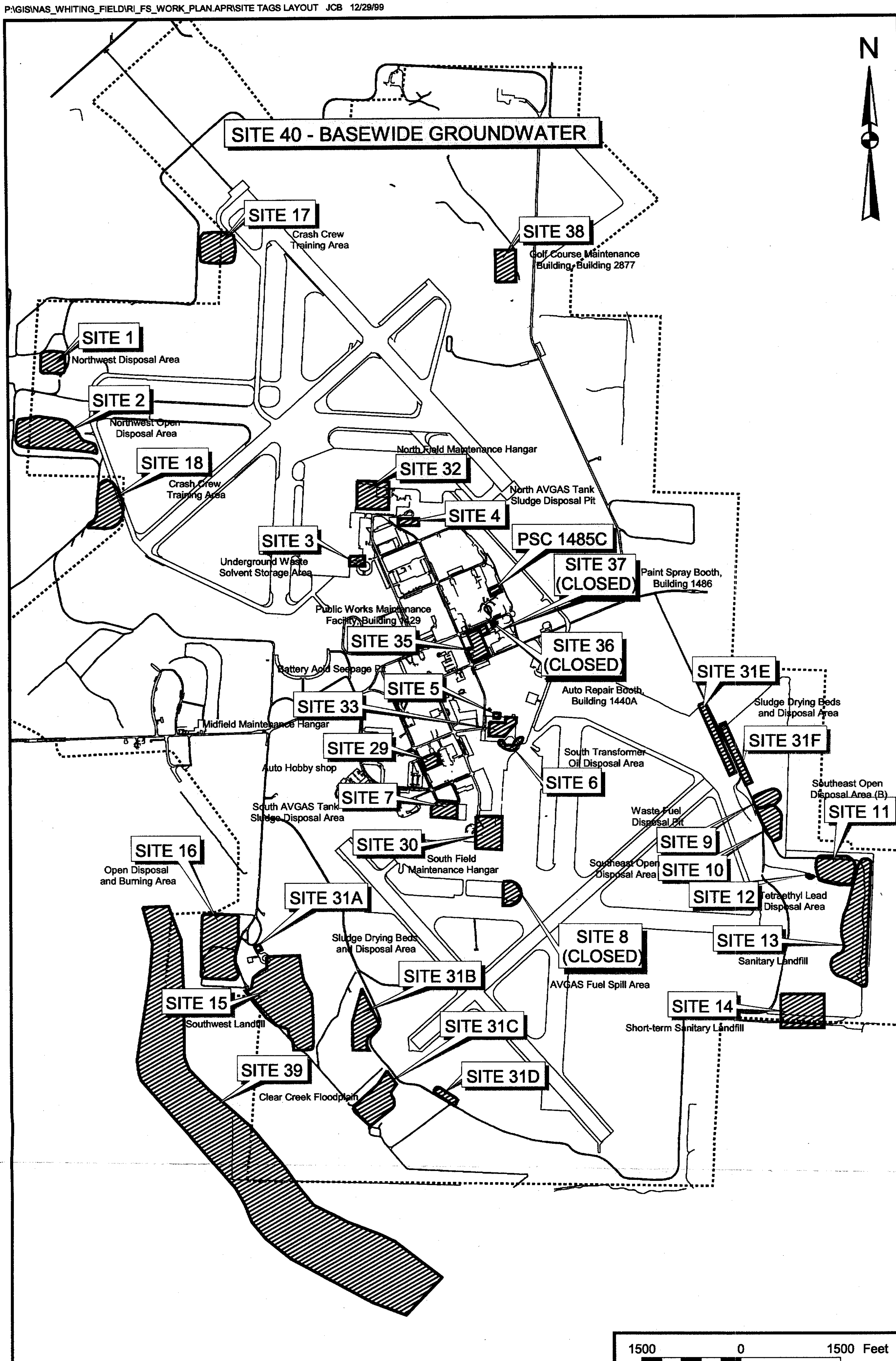

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1.3 PURPOSE OF THE INVESTIGATIONS: SITE ASSESSMENT AND REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

The purpose of the Site Assessment investigation is to collect data and characterize the site to determine if a RI will need to be conducted. The purpose of the RI is to collect data and characterize the site to assess the threat(s) to human health and the environment, while the FS serves to identify a range of remedial alternatives to address any identified risk. To achieve this objective, an RI will be conducted to assess the nature and distribution of chemicals associated with a number of sites at the installation. The data collected during the RI field program will be used in the FS to evaluate and select remedial alternatives to provide permanent, feasible solutions to environmental contamination problems at NAS Whiting Field.

This Work Plan was prepared by Tetra Tech NUS, Inc. (TtNUS) under a Comprehensive Long-term Environmental Action Navy (CLEAN) contract with the SOUTHNAVFACENGCOM for conducting an RI/FS at Sites 7, 29, 35, 39 and 40, and a Site Assessment at Sites 5 and 38 and PSC 1485C.

The Site Assessment will be conducted in accordance with the methods described in the following USEPA document: *Guidance for Performing Site Inspections Under CERCLA (1992)*.

The RI/FS will be conducted in accordance with the methods described in the following USEPA documents: *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (1988a), *The Superfund Accelerated Cleanup Model (SACM)* (1992a), *Final Guidance: Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites* (1996a), *Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with Volatile Organic Compounds in Soils* (1993a), and *Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites* (1988b).

The objectives of the investigations described in this workplan are to:

- Determine the nature and distribution of contaminants at the site.
- Identify potential threats to public health or the environment posed by the potential release of contaminants from the site.
- Evaluate potential remedial alternatives based on engineering factors, implementability, environmental and public health concerns and costs.

This Work Plan presents the technical scope of actions necessary to achieve these objectives and the schedule for conducting field activities, preparing reports, and developing and evaluating remedial alternatives. The program has been designed to be as efficient and streamlined as possible to support a rapid data acquisition and evaluation process during the investigation. To this end, investigators begin with the understanding that it will not be possible to completely characterize this site or any other similar site, even with a very large number of explorations and chemical analyses. Rather, the approach will be to sufficiently characterize the site with a limited number of explorations and analyses that will permit development and refinement of a conceptual model based on reasonable conclusions drawn from those data. USEPA's presumptive response strategy will be used to identify remedial alternatives that will be evaluated during the FS process, and the investigation will be planned to provide technology-specific data required to support selection of the presumptive response. Contingencies are included in this Work Plan that may be invoked at any time during the investigation when it becomes apparent that probable conditions have given way to deviations. In this situation, a working hypothesis will be formulated that will evolve and grow as knowledge of the site increases, providing a balance between managed uncertainties and site investigation activities, resulting in improved efficiencies.

This Work Plan consists of nine sections and seven appendices. Section 1.0 provides an introduction to the process and a description of the components of the Work Plan. Section 2.0 summarizes the site background and setting and includes a description of the site, its history, the geologic and hydrogeologic settings, and a summary of the results of previous investigations. Also in Section 2.0 is an approach overview that presents and discusses the concepts of streamlining and presumptive remedies (USEPA 1993a and 1996a) as well as an evaluation of data needs. Section 3.0 provides the rationale and task-by-task approach for the field investigation activities. Section 4.0 describes the laboratory analytical program. The risk assessment and waste management [investigation-derived waste (IDW)] tasks are described in Sections 5.0 and 6.0, respectively. Section 7.0 describe the Site Assessment and RI reports and Section 8.0 describes the FS report. The project schedule is presented in Section 9.0. Appendix A contains a summary of potential federal and state applicable or relevant and appropriate requirements (ARAR's) that may apply to these Sites. Field investigation procedures and forms are contained in Appendix B, Appendix C contains a time line and history for Clear Creek, and the NAS Whiting Field IDW Management Plan is included in Appendix D. The Final Health and Safety Plan and Quality Assurance Project Plan are included in Appendix E and F, respectively. Appendix G includes the UST Closure Assessment and Data from the Used Oil Site (Site 29).

2.0 INSTALLATION BACKGROUND AND SETTING

2.1 INSTALLATION LOCATION AND DESCRIPTION

NAS Whiting Field is located in Santa Rosa County, in Florida's northwest coastal area, approximately 5.5 miles north of Milton and 25 miles northeast of Pensacola (Figure 1-1). Mobile, Alabama, is approximately 79 miles west of the air station, and Tallahassee, the capital of Florida, is 174 miles to the east. NAS Whiting Field presently consists of two airfields (North and South Fields) separated by an industrial area. North Field is used for fixed-wing aircraft training, while South Field is used for helicopter training. The installation is approximately 3,842 acres in size. NAS Whiting Field provides the support facilities for flight and academic training. Most of these services and support activities are provided by private contractors. Figure 1-2 presents the installation layout and the locations of the sites at NAS Whiting Field.

Land surrounding NAS Whiting Field consists primarily of agricultural land to the northwest, residential and forested areas to the south and southwest, and forests along the remaining boundaries.

Located on an upland area, elevations at NAS Whiting Field range from 30 to 190 feet above sea level. The facility is bounded by low-lying receiving waters: Clear Creek to the west and south and Big Coldwater Creek to the east. These two streams are tributaries of the Blackwater River. The Blackwater River discharges to the estuarine waters of the East Bay of the Escambia Bay coastal system. Both Clear Creek and Big Coldwater Creek are classified by the Florida Department of Environmental Protection (FDEP) as Class II Waters–Recreation–Propagation and Management of Fish and Wildlife. The Blackwater River is classified as an Outstanding Florida Water. Outstanding Waters are considered to be of exceptional recreational and ecological significance.

2.2 INSTALLATION HISTORY

NAS Whiting Field was constructed in the early 1940s and commissioned as a Naval Auxiliary Air Station in July 1943. NAS Whiting Field has served as a naval aviation training facility ever since its commissioning. The field's mission has been to train student naval aviators in the use of basic instruments, formation and tactical phases of fixed-wing, propeller-driven aircraft, and basic and advanced helicopter operation.

NAS Whiting Field is the home of TRAWING FIVE. Subordinate commands currently stationed at NAS Whiting Field include fixed-wing training squadrons VT-2, VT-3, and VT-6 and helicopter training squadrons HT-8 and HT-18. VT-2 and VT-3 are stationed at North Field. VT-6 was originally stationed at South Field; however, in 1972, with the transfer of HT-8 and HT-18 to South Field, VT-6 was transferred to North Field. This division still exists, with North Field being used for fixed-wing training and South Field for helicopter training.

2.3 GEOLOGIC SETTING

The following discussion of the geologic setting at NAS Whiting Field is based on *Technical Memorandum No. 2 (Final), Geologic Assessment, Remedial Investigation and Feasibility Study, Phase IIA* [ABB Environmental Services, Inc. (ABB-ES) 1995a].

The majority of Santa Rosa County, including NAS Whiting Field, is located in the Western Highlands subdivision of the Coastal Plain Physiographic province. The Coastal Plain Physiographic province is a major division of the United States that extends eastward from Texas and as far north as New York. The Coastal Plain is primarily underlain by beds of sand, silt, clay, and limestone that dip gently toward the coast. Most of these sediments were deposited during periods of elevated sea levels.

The Western Highlands subdivision consists of a well-drained, southward-sloping plateau that has been eroded by numerous streams (Scott 1992). Three marine shorelines can be recognized from existing topographic profiles across Escambia and Santa Rosa Counties. The shoreline at 30 feet above National Geodetic Vertical Datum (NGVD) is visible as the Pimlico terrace, the Penholoway terrace represents the relic shoreline at 70 feet above NGVD, and the third shoreline is a seaward-sloping upland surface ranging from 70 to 270 feet above NGVD (Marsh 1966).

The southwestward dip of all the formations (down to the Cretaceous-period deposits) in Santa Rosa County is explained by the fact the area is located on the eastern flank of the Mississippi embayment (westward dip) and the northern flank of the Gulf Coast Geosyncline (southward dip) (Marsh 1966). The Gulf Coast Geosyncline, located slightly south of the present coastline, was created by subsidence during deposition of 50,000 feet of Tertiary deposits. The local structure created by these regional features is a simple homocline with few faults and folds found in northern Santa Rosa County.

The subsurface geology of Santa Rosa County has more in common with the central Gulf Coast of Alabama, Mississippi, and Louisiana than it does with that of peninsular Florida. Only two peninsular Florida units (the Tampa Formation and the Ocala Group) are present within the area (Marsh 1966).

NAS Whiting Field is underlain by a thick sequence of Tertiary sedimentary formations. A generalized geologic column of these formations is presented in Figure 2-1. The regional geologic characterization presented in this section was compiled using numerous documents prepared by the Florida Geologic Survey (Marsh 1966; Musgrove, Barraclough, and Grantham 1965; Scott 1992).

The oldest formation studied in the panhandle area (Escambia and Santa Rosa Counties) is the Hatchetigbee Formation of the early Eocene series. This formation is composed of silty clay with beds of glauconitic shale and shaly limestone. The average thickness of the Hatchetigbee Formation is 315 feet (Marsh 1966).

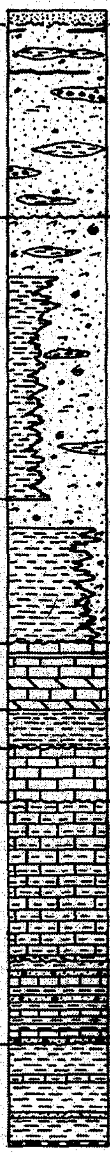
Overlying the Hatchetigbee is the Tallahatta Formation of middle Eocene, consisting of shale and siltstone deposits interbedded with gray limestone and well-sorted sand. Above the Tallahatta is the Lisbon equivalent that has been correlated with the Lisbon Formation of Alabama. The Lisbon is approximately 500 feet thick and consists of a shaly limestone (Marsh 1966; Scott 1992).

The upper Eocene series is represented by the Ocala Group. The Ocala is a light-gray limestone and averages 165 feet in thickness. Fifty-seven species of Foraminifera were identified in this group. Unconformably overlying the Ocala is the Bucatunna Clay member of the Byram Formation. The Bucatunna is a dark gray, soft clay averaging 125 feet in thickness throughout the western Florida Panhandle (Marsh 1966; Scott 1992).

The Chickasawhay Limestone and Tampa Formation are so similar in the western Panhandle that they are presented as undifferentiated on the geologic column. The Chickasawhay is a gray, dolomitic limestone, while the Tampa is a light gray to white, hard limestone (generally not dolomitic). These undifferentiated sediments range in thickness from 30 to 270 feet in western Florida; however, they are believed to be between 100 and 150 feet thick in northern Santa Rosa County (Marsh 1966; Scott 1992).

Above the Chickasawhay-Tampa Formation lies the Pensacola clay, consisting of an upper and lower member of dark to light gray, sandy clay. These two members are separated by the Escambia sand member of gray, fine- to coarse-grained sand (Marsh 1966; Scott 1992). The upper member of the Pensacola clay is not present in the immediate vicinity of NAS Whiting Field, and the lower member is believed to pinch out north of the installation (Marsh 1966).

GENERALIZED GEOLOGIC COLUMN
OF FORMATIONS IN THE WESTERN FLORIDA PANHANDLE



SERIES	GRAPHIC SECTION	FORMATION
PLEISTOCENE		MARINE TERRACE DEPOSITS: Sand, light tan, fine to coarse
PLEISTOCENE (?)		CITRONELLE FORMATION: Sand with lenses of clay and gravel. Sand, light-yellowish-brown to reddish-brown, very fine to very coarse and poorly sorted. Hardpan layers in upper part. Logs and carbonaceous zones present in places. Fossils extremely scarce except near the coast where shell beds may be the marine equivalent of the fluvial facies of the Citronelle.
UPPER MIOCENE		MIOCENE COARSE CLASTICS: Fossiliferous sand with lenses of clay and gravel. Sand is light-gray to light-brown, very fine to very coarse and poorly sorted. Fossils abundant, mostly minute mollusks. Contains a few zones of carbonaceous material. Lower part of coarse clastics present only in northern part of area, interfingering with Pensacola Clay in the central part.
UPPER MIDDLE TO LOWER UPPER MIOCENE		PENSACOLA CLAY: Formation consists of an Upper Member and Lower Member of dark-to-light-gray, tough, sandy clay; separated by the Escambia Sand Member of gray, fine to coarse, quartz sand. Contains carbonized plant fragments, and abundant mollusks and foraminifers. Pensacola Clay is present only in southern half of area, interfingering with the Miocene coarse clastics in the central part.
LOWER MIOCENE AND UPPER OLIGOCENE		CHICKASAWHAY LIMESTONE AND TAMPA FORMATION UNDIFFERENTIATED <u>Tampa</u>: Limestone, light-gray to grayish-white, hard, with several beds of clay; <u>Chickasawhay</u>: Dolomitic limestone, gray, vesicular.
MIDDLE OLIGOCENE		BUCATUNNA CLAY MEMBER OF BYRAM FORMATION: Clay, dark-gray soft, silty to sandy, foraminiferal, carbonaceous.
UPPER EOCENE		OCALA GROUP: Limestone, light-gray to chalky-white foraminifers extremely abundant, esp. <u>Lepidocyclina</u>; corals, echinoids, mollusks, bryozoans.
MIDDLE EOCENE		LISBON EQUIVALENT: Shaly limestone, dark-gray to grayish-cream; hard, compact; glauconitic; with thick intervals of dense, light-gray shale.
		TALLAHATTA FORMATION: Shale and siltstone, light-gray, hard, with numerous interbeds of gray limestone and very fine to very coarse, pebbly sand. Foraminifers locally abundant.
LOWER EOCENE		HATCHETIGBEE FORMATION: Clay, gray to dark-gray, micaceous, silty, with beds of glauconitic shale, siltstone, and shaly limestone. Mollusks, foraminifers, corals, echinoids. Bashi Marl Member (about 10 feet thick) at base.

Figure 2. — Generalized geologic column of formations in the western Florida Panhandle.

SOURCE:
MODIFIED FROM MARSH 1966.

FIGURE 2-1

GENERALIZED GEOLOGIC COLUMN OF WESTERN FLORIDA PANHANDLE

RI/FS WORK PLAN
SITES 5, 7, 29, 35, 38, 39, 40 AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA

CAD FILE NO./DATE: 0052A006.dgn/1-5-2000

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Miocene coarse clastics, however, are present throughout the western Florida Panhandle. These coarse clastics are described as brown to gray, poorly sorted sand and gravel with thick lenses of clay. These sediments overlie the Chickasawhay limestone in the vicinity of NAS Whiting Field (Marsh 1966).

The Citronelle Formation of Pleistocene age overlies the Miocene coarse clastics and is very similar in composition. The two units are differentiated by the abundance of shells in the Miocene coarse clastics. The thickness of the Citronelle Formation ranges from 40 to 800 feet in westernmost Florida, and between 250 and 400 feet in northern Santa Rosa County. The Citronelle Formation also contains layers of fossil wood, limonite-cemented zones, shells, and kaolinitic burrows of aquatic animals (Marsh 1966; Scott 1992).

The overlying marine terrace deposits are thin in comparison to the Citronelle Formation and are indistinguishable from Citronelle sediments. They are typically included in the average thickness of the formation (Marsh 1966).

In Escambia and Santa Rosa Counties, the Citronelle Formation consists principally of quartz sand that contains numerous lenses, beds, and stringers of clay and gravel. The lithology changes abruptly over short distances. The sand is typically light yellowish-brown to reddish-brown, although some is white or light gray. The grains are typically angular to subangular and very poorly sorted; ranging from very finely to very coarsely grained. Clay occurs in lenses as thick as 60 feet and is primarily white or gray in color, although lavender and yellow brown are not uncommon. The rapid facies changes, absence of fossils, and presence of sand and gravel suggest that the shallow sediments of the sand and gravel aquifer were deposited in an environment similar to that of the current Mississippi River delta. The sediments were probably deposited in stream channels, which continually shifted back and forth across the face of the delta. The clay lenses were deposited in quiet pools or abandoned channels, whereas the gravel was deposited in swiftly moving streams nearby (Musgrove, Barraclough, and Grantham 1965).

2.4 HYDROGEOLOGIC SETTING

NAS Whiting Field is located within the boundaries of the Northwest Florida Water Management District (NWFWMD), which encompasses the entire Florida panhandle. The topography of northwest Florida is the result of 25 million years of stream erosion and deposition in addition to wave action during periods when the shoreline exceeded its present level. The resulting surficial sediments consist of sand and silt mixtures containing interbedded clay lenses (ABB-ES 1995b).

2.4.1 Regional Hydrogeology

Groundwater in northwest Florida occurs within three major aquifer systems. These aquifer systems include: the surficial aquifer system (referred to as the sand-and-gravel aquifer in the western panhandle), the intermediate aquifer system and confining unit, and the Floridan aquifer system (NWFWMD 1988; Scott 1992).

The three aquifer systems in Escambia and Santa Rosa Counties differ significantly from their counterparts throughout the remainder of the district. For example, the sand-and-gravel aquifer is considerably thicker in the western part of the panhandle than is its counterpart (the surficial aquifer) in the eastern part of the panhandle (NWFWMD 1988). The intermediate system in the eastern part of the panhandle consists of a confining layer that contains thin water-bearing zones. The confining layer is called the Pensacola Clay in Escambia and Santa Rosa Counties. It consists of upper and lower members separated by the Escambia sand member. The upper member pinches out west of Milton, and the lower member is absent in the northern half of Escambia and Santa Rosa Counties. The installation is situated at the approximate location where the lower member begins interconnecting with the Miocene coarse clastics. Although the intermediate system contains water-bearing units, it functions primarily as a confining unit between the surficial (sand-and-gravel) aquifer and the Floridan aquifer throughout the entire district. The Floridan aquifer in Escambia and Santa Rosa Counties contains a confining unit (the Bucatunna Clay Member of the Byram Formation, middle Oligocene in age) that divides the Floridan aquifer into upper and lower units. The Bucatunna Clay is present in only the western part of the panhandle (NWFWMD 1988; Scott 1992).

The sand-and-gravel aquifer is the major water-bearing unit in Santa Rosa County and the only aquifer that has been studied in the IR program at NAS Whiting Field. The aquifer consists of a complex sequence of sand, gravel, silt, and clay estimated to be approximately 350 feet thick in the vicinity of the airfield (Scott 1992). The sand-and-gravel aquifer includes the upper Miocene coarse clastics, the Citronelle Formation, and marine terrace deposits. These units have similar hydraulic properties and sometimes are indistinguishable. The aquifer consists of poorly sorted, fine- to coarse-grained sands with gravel and lenses of clay that may be as thick as 60 feet. The presence of interbedded clay layers often creates localized artesian conditions in which the less permeable clay deflects the surface of the water table below its true (unconfined) elevation. In some areas the aquifer may be subdivided into upper and lower zones, which are separated by layers of clay or clayey sand. These semiconfining layers are typically leaky, and the upper part serves as the primary source of recharge to the more productive lower zone of the aquifer (NWFWMD 1991). Groundwater can also potentially move laterally along the semiconfining layers until it discharges into local streams or other surface water features (NWFWMD 1991; Scott 1992).

Throughout most of the Florida panhandle, the bottom of the sand-and-gravel aquifer is typically marked by the intermediate aquifer system. In Escambia County, the Pensacola Clay Formation serves as the confining layer. Throughout most of Santa Rosa County, only the lower member of the formation is thought to overlay the top of the Upper Floridan. NAS Whiting Field is located approximately 4 miles south of where the lower member pinches out completely (Musgrove, Barraclough, and Grantham 1965).

Virtually all of the groundwater used in Santa Rosa County is pumped from the sand-and-gravel aquifer. The aquifer is recharged entirely by rainfall. The western panhandle receives between 55 and 67 inches of rainfall per year (NWFWMD 1988). Evapotranspiration returns approximately 60 percent of the total volume of rainfall to the hydrologic cycle before entering the aquifer systems. Rainfall is generally highest in the summer months and lowest in fall and winter.

The water quality of the sand-and-gravel aquifer is satisfactory for most uses. The concentrations of naturally occurring dissolved minerals are low due to the insolubility of the sand through which the water migrates. The pH of water in the aquifer falls as low as 5.0 in some areas, largely as a result of high concentrations of dissolved iron (Florida Geological Survey 1992).

The hydraulic properties of the sand-and-gravel aquifer have been studied throughout Escambia County (NWFWMD 1991). The results of this work have indicated the transmissivity of the main producing zone is variable throughout the county (5,000 to 20,000 square feet/day) and the values from the western part of the county fall within the lower end of the range. The average storativity for the main producing zone is on the order of 1×10^{-4} (dimensionless). Transmissivity calculated from multi-well aquifer tests conducted by NWFWMD ranged from 5,800 to 7,800 square feet/day, with storage coefficients of 2.9×10^{-4} to 5.7×10^{-4} (dimensionless) (NWFWMD 1991).

2.4.2 Groundwater Flow Direction

Shallow, intermediate, and deep groundwater flow patterns in the sand and gravel aquifer were determined based on water level data from monitoring wells. Figures 2-2 and 2-3 provide a graphic representation for the shallow and deep flow zones, respectively, collected during the February 8 and 9, 1994, water level measurement event. Groundwater flow contour maps were also completed for the September 30 and October 1, 1993, measurement event. Both shallow and deep zone groundwater maps showed flow patterns similar to those on the February 1994 flow maps. Because of the limited number of intermediate zone monitoring wells, the flow direction was not determined for this interval (ABB-ES 1995b). As indicated on Figures 2-2 and 2-3, both shallow and deep groundwater flow throughout most of the Industrial Area is to the south and southwest.

A review of the monitoring well data indicated a perched groundwater flow zone corresponding with previously identified clay layers lies within the Industrial Area. A comparison of groundwater elevations with lithologic logs for individual monitoring wells indicated potential perched groundwater conditions at Sites 3 and 4 [Underground Storage Tank (UST) Site 1467], Site 7 (UST Site 1466), and Site 29 (Auto Hobby Shop). Figure 2-4 shows the inferred groundwater contours for the perched zone within the Industrial Area.

The variation in water levels between identified perched monitoring wells and monitoring wells screened across the water table ranged from 2.31 feet at Site 3 (monitoring well WHF-3-2) to 8.98 feet at Site 29. The largest difference in water level elevations occurred north of Site 4 (UST Site 1467) in UST wells WHF-1467-6D and WHF-1467-26, where the water levels varied by 17.61 feet. Interpretation of the perched groundwater potentiometric surface suggests a more irregular flow pattern than that of the shallow (Figure 2-2) or deep (Figure 2-3) flow zones. The irregular flow pattern is probably a result of influence by the surface of the clay layer upon which it is perched (ABB-ES 1995b).

2.4.3 Horizontal and Vertical Gradients

Horizontal hydraulic gradients in the Industrial Area varied over one order of magnitude. Values ranged from 0.016 feet/feet (monitoring wells WHF-29-5 and WHF-29-4) to 0.0002 feet/feet (monitoring wells WHF-30-5 and WHF-30-3). The average horizontal hydraulic gradient for the Industrial Area was the same (0.0046 feet/feet) for measurement events conducted in October 1993 and February 1994 (ABB-ES 1995b).

Vertical hydraulic gradients varied by up to two orders of magnitude from 0.0486 feet/feet at Site 3 well cluster WHF-3-3 to 0.0006 at Site 5 well cluster WHF-5-9. The direction of the vertical hydraulic gradient was predominantly downward. An upward hydraulic gradient occurred at one well cluster (WHF-6-1) at Site 6, and two well clusters (WHF-3-7 and WHF-5-9) indicated a reversal of flow direction from downward to upward between the groundwater elevation measurement events (ABB-ES 1995b)

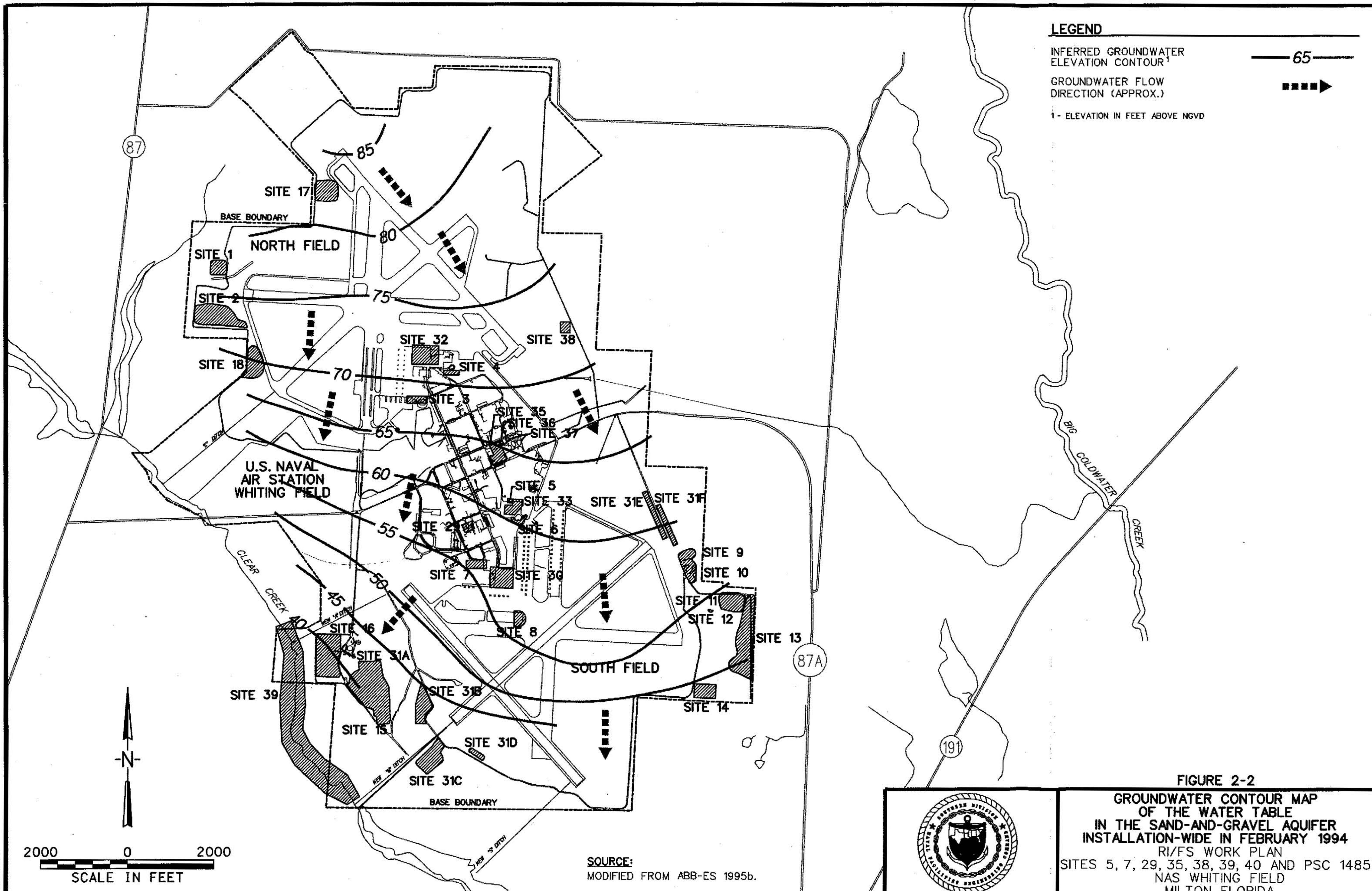

FIGURE 2-2

GROUNDWATER CONTOUR MAP OF THE WATER TABLE IN THE SAND-AND-GRAVEL AQUIFER INSTALLATION-WIDE IN FEBRUARY 1994

RI/FS WORK PLAN
SITES 5, 7, 29, 35, 38, 39, 40 AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA

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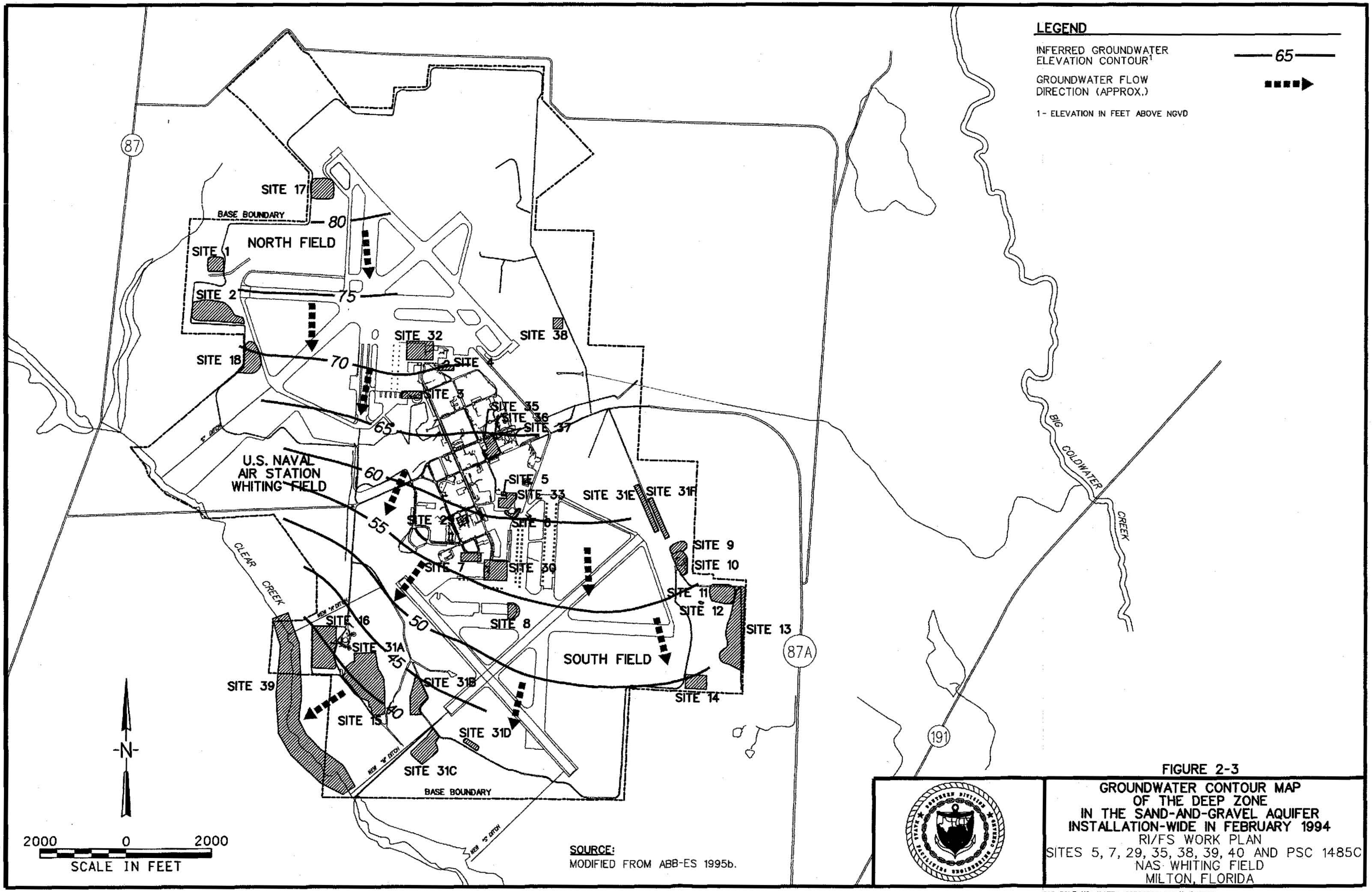

FIGURE 2-3
GROUNDWATER CONTOUR MAP OF THE DEEP ZONE IN THE SAND-AND-GRAVEL AQUIFER INSTALLATION-WIDE IN FEBRUARY 1994
RI/FS WORK PLAN
SITES 5, 7, 29, 35, 38, 39, 40 AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA

CAD FILE NO./DATE: 0052A004.dgn/1-5-2000

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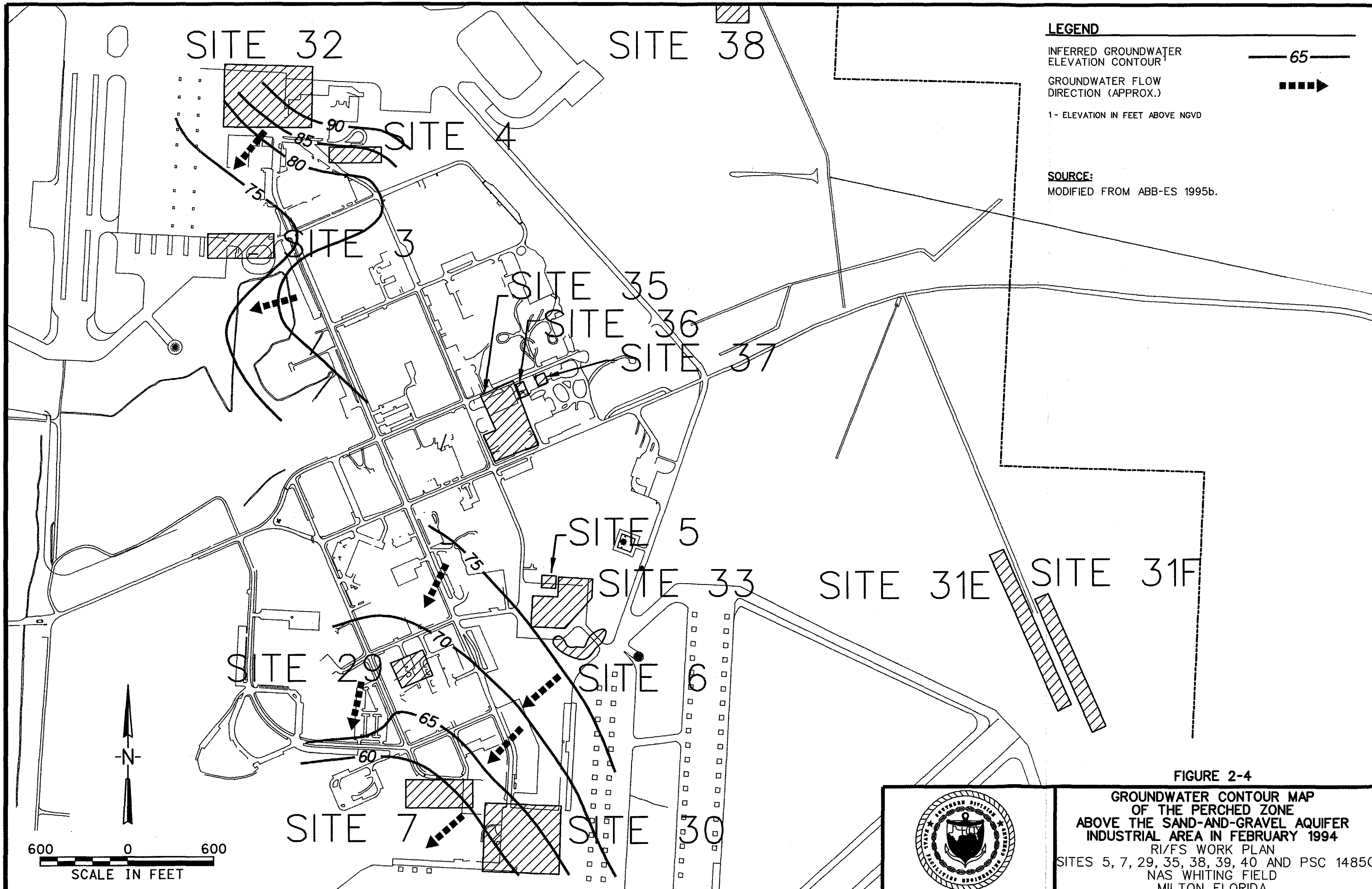

FIGURE 2-4

GROUNDWATER CONTOUR MAP OF THE PERCHED ZONE ABOVE THE SAND-AND-GRAVEL AQUIFER INDUSTRIAL AREA IN FEBRUARY 1994

RI/FS WORK PLAN
SITES 5, 7, 29, 35, 38, 39, 40 AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA

CAD FILE NO./DATE: 0052A005.dgn/1-5-2000

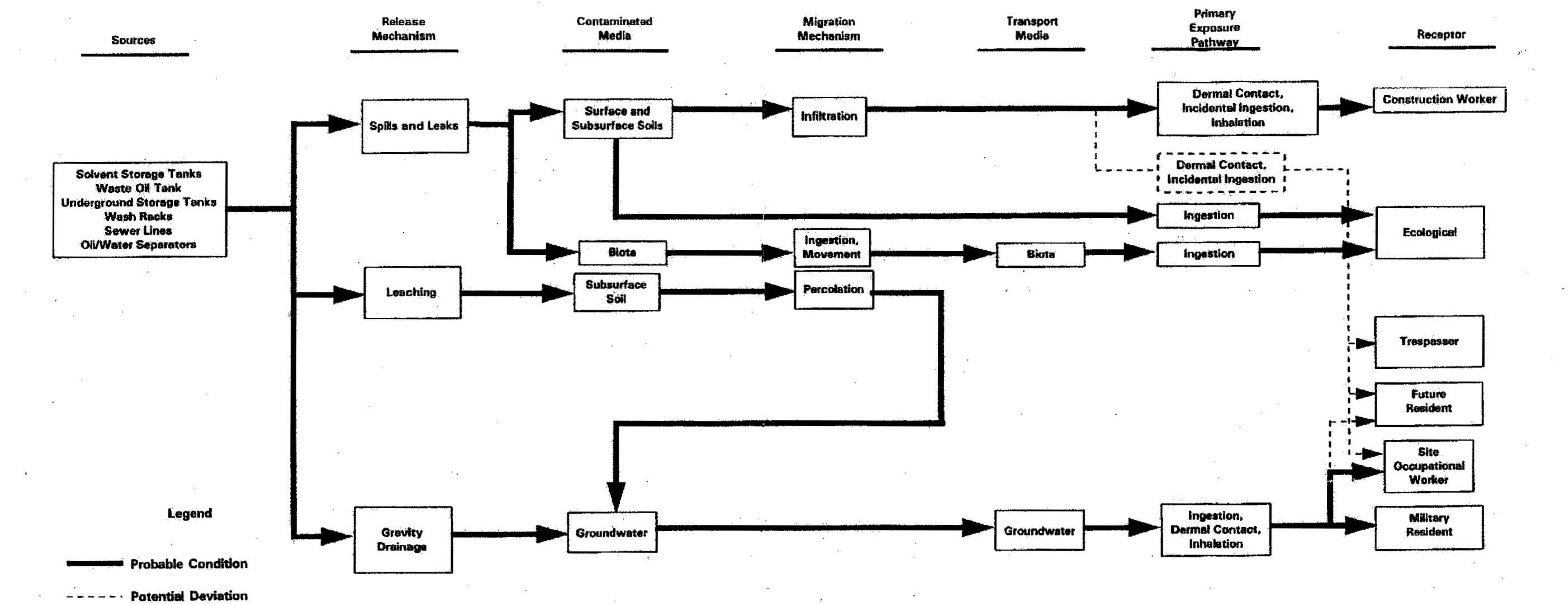

FIGURE 2-5

CONCEPTUAL SITE MODEL

RI/FS WORK PLAN
SITES 5, 7, 29, 35, 38, 39, 40 AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA

CAD FILE NO./DATE: 0052A007.dgn/1-5-2000

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Vertical hydraulic gradients varied by up to two orders of magnitude from 0.0486 feet/feet at Site 3 well cluster WHF-3-3 to 0.0006 at Site 5 well cluster WHF-5-9. The direction of the vertical hydraulic gradient was predominantly downward. An upward hydraulic gradient occurred at one well cluster (WHF-6-1) at Site 6, and two well clusters (WHF-3-7 and WHF-5-9) indicated a reversal of flow direction from downward to upward between the groundwater elevation measurement events (ABB-ES 1995b)

2.4.4 Hydraulic Conductivity and Seepage Velocity

Slug tests were conducted at 12 shallow and 5 deep monitoring wells. From a total of 59 slug tests performed on the wells, 45 were deemed usable. Hydraulic conductivity for the shallow and intermediate monitoring wells varied from 31.16 feet/day (1.10×10^{-2} cm/sec) at Site 5 to 0.35 feet/day (1.24×10^{-4} cm/sec) at Site 6 (South Transformer Oil Disposal Area). The geometric mean across the Industrial Area was 4.48 feet/day (1.57×10^{-3} cm/sec) for the shallow and intermediate-depth monitoring wells. For the deep monitoring wells, hydraulic conductivity ranged from 41.46 feet/day (1.46×10^{-2} cm/sec) (WHF-3-7D) to 0.32 feet/day (1.12×10^{-4} cm/sec) (WHF-5-8D). The geometric mean for the deep wells was 6.67 feet/day (2.35×10^{-3} cm/sec; ABB-ES 1995b).

The shallow and intermediate monitoring well screen elevations ranged from 77 feet above to 2 feet below mean sea level (MSL). The sediments in this depth range varied from poorly graded sands to clayey/silty sands. The deep monitoring well screen elevations ranged from 11 feet above to 12 feet below MSL. The lithologies in this depth range varied from well-graded to poorly graded, dense sands (ABB-ES 1995b).

The calculated seepage velocity value for the Industrial Area ranged from 0.48 feet/day at Site 29 to 0.004 feet/day at Site 6. The average of the seepage velocity values for the Industrial Area was 0.11 feet/day (ABB-ES 1995b).

2.5 PREVIOUS INVESTIGATIONS

Table 2-1 Summary of Site Investigations and Table 2-2 Summary of Potential Sites contain information of previous investigations at NAS Whiting Field.

2.6 INVESTIGATION APPROACH OVERVIEW

The current system for Superfund cleanups allows for two cleanup pathways: remedial actions and removal actions. The remedial action pathway is traditionally structured toward long-term remedies that address risk as predicted under future scenarios. This traditional process has led to long study-based

Table 2-1
Summary of Groundwater Investigations

RI/FS Work Plan for Sites 5, 7, 27, 35, 38, 40, and PSC 1485C
NAS Whiting Field, Milton, Florida

Site No.	Site Name	Previous Groundwater Studies							
		Verification Study[1] (June 1986)	RI/FS Phase I[2] (May 1991)	RI/FS Phase IIA[3] (April 1994)	Navy's UST Program[4] (Aug 1993)	RI/FS Phase IIB[5] (Nov 1995)	RI/FS Phase IIB[6] (Aug 1997)	Site Screening Investigation[7] (June 1997)	RI/FS Phase IIC[8] (May 1998)
1	Northwest Disposal Area	*	*	*		*	*		
2	Northwest Open Disposal Area			*		*	*		
3	Underground Waste Solvent Storage Area	*	*	*		*	*		*
4/1467	North AVGAS Tank Sludge Disposal Area	*		*	*	*	*		*
5	Battery Acid Seepage Pit			*		*	*		
6	South Transformer Oil Disposal Area	*	*	*		*	*		
7/1466	South AVGAS Tank Sludge Disposal Area	*		*	*	*	*		
8	AVGAS Fuel Spill Area	*			(1)				
9	Waste Fuel Disposal Pit	*	*	*		*	*		
10	Southeast Open Disposal Area (A)	*	*	*		*	*		
11	Southeast Open Disposal Area (B)	*	*	*		*	*		
12	Tetraethyl Lead Disposal Area	*	*	*		*	*		
13	Sanitary Landfill	*	*	*		*	*		

See notes at end of table.

Table 2-1 continued
Summary of Groundwater Investigations

RI/FS Work Plan for Sites 5, 7, 27, 35, 38, 40, and PSC 1485C
NAS Whiting Field, Milton, Florida

Site Number	Site Name	Previous Groundwater Studies							
		Verification Study (June 1986)	RI/FS Phase I[2] (May 1991)	RI/FS Phase IIA[3] (April 1994)	Navy's UST Program[4] (Aug 1993)	Navy's UST Program[4] (Aug 1993)	RI/FS Phase IIB[6] (Aug 1997)	Site Screening Investigation[7] (June 1997) P	RI/FS Phase IIC[8] (May 1998)
14	Short-term Sanitary Landfill	*	*	*		*	*		
15	Southwest Landfill	*	*	*		*	*		
16	Open Disposal and Burning Area	*	*	*		*	*		
17	Crash Crew Training Area	*	*	*		*	*		
18	Crash Crew Training Area	*	*	*		*	*		
29	Auto Hobby Shop			*		*	*		
30	South Field Maintenance Hangar Area			*		*	*		
31	Sludge Drying Beds and Disposal Areas			*		*	*		
32	North Field Maintenance Hangar Area			*		*	*		*
33	Midfield Maintenance Hangar Area			*		*	*		
35	Building 1429, Public Works Maintenance Facility							*	
36	Building 1440A, Auto Repair Booth							*	

See notes at end of table.

Table 2-1 continued
Summary of Groundwater Investigations

RI/FS Work Plan for Sites 5, 7, 27, 35, 38, 40, and PSC 1485C
NAS Whiting Field, Milton, Florida

Site Number	Site Name	Previous Groundwater Studies							
		Verification Study (June 1986)	RI/FS Phase I[2] (May 1991)	RI/FS Phase IIA[3] (April 1994)	Navy's UST Program[4] (Aug 1993)	Navy's UST Program[4] (Aug 1993)	RI/FS Phase IIB[6] (Aug 1997)	Site Screening Investigation[7] (June 1997)	RI/FS Phase IIC[8] (May 1998)
37	Building 1486, Paint Spray Booth							*	
38	Building 2877, Former Golf Coarse Maintenance Building								
39	Clear Creek Flood Plain								
40	Facility-wide Groundwater								
1485C	Pesticide Storage Building 1485C								

Notes:

[1] Geraghty & Miller, Inc., 1986, Verification Study Assessment of Potential Groundwater Pollution at NAS Whiting field Milton Florida.

[2] ABB-ES, 1992, Remedial Investigation and Feasibility Study Phase I, Naval Air Station Whiting Field Milton Florida, Technical Memorandum No. 5 Groundwater Quality Assessment, Final Report

[3] ABB-ES, 1995, Remedial Investigation and Feasibility Study Phase IIA, Technical Memorandum No. 5 Groundwater Assessment, Naval Air Station Whiting Field Milton, Florida, Final Report.

[4] ABB-ES, 1994, Jurisdiction Assessment Report, Underground Storage Tank Program Sites1466 and 1467, Installation Restoration Program Sites 4 and 7, Naval Air Station Whiting Field, Milton, Florida. Final Report

[5] ABB-ES, 1996, Remedial Investigation Industrial Area Groundwater Investigation Interim Report, Naval Air Station Whiting Field Milton Florida, Draft Report

[6] ABB-ES, 1998, Industrial Area Groundwater Investigation Interim Report Addendum, Naval Air Station Whiting Field Milton, Florida, Draft Report

[7] Harding Lawson Associates, Inc., 1999, Draft Final Report on the Investigation at sites 35, 36, and 37 naval Air Station Whiting Field, Milton Florida

[8] The analytical results for the groundwater sampling event have not been presented. The analytical results will be presented and discussed in the RI report for Site 40.

TABLE 2-2

SUMMARY OF POTENTIAL DISPOSAL SITES
WORK PLAN FOR
SITES 5, 7, 29, 35, 38, 39, 40, AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 3

Site No.	Site Name and Type	Location	Period of Operation	Types of Material Disposed of	Comments
1	Northwest Disposal Area (landfill)	North Field, west side	1943–1965	Refuse, waste paints, thinners, solvents, waste oils, and hydraulic fluids.	Secondary disposal area during this period; site covers 5 acres.
2	Northwest Open Disposal Area (landfill)	North Field, west side	1976–1984	Construction and demolition debris, tires, and furniture.	Former borrow pit location, commonly referred to as the "Wood Dump."
3	Underground Waste Solvent Storage Area (tank)	North Field, south of Building 2941	1980–1984	Waste solvents, paint stripping residue, and 120-gallon spill.	Wastes generated by paint stripping operations.
4	North AVGAS Tank Sludge Disposal Area	North Field, north of Tow Lane	1943–1968	Tank-bottom sludge containing tetraethyl lead.	Sludge disposal in shallow holes near tanks.
5	Battery Acid Seepage Pit (contaminated soil)	South Field, southwest of Building 1454	1964–1984	Waste electrolyte solution containing heavy metals and waste battery acid.	Pits located 110 feet from potable supply well (W-S2).
6	South Transformer Oil Disposal Area (contaminated soil)	South Field, southeast of Building 1454	1940s–1960s	PCB–contaminated dielectric fluid.	Disposal in drainage ditch.
7	South AVGAS Tank Sludge Disposal Area (landfill and tanks)	South Field, west of Building 1406	1943–1968	Tank-bottom sludge containing tetraethyl lead.	Sludge disposed of in shallow holes near tanks.
8	AVGAS Fuel Spill Area (contaminated soil)	South Field, south of Building 1406	Summer 1972	AVGAS containing tetraethyl lead.	Fuel spill of about 25,000 gallons on an area of about 2 acres.
9	Waste Fuel Disposal Pit (landfill)	South Field, east side	1950s–1960s	Waste AVGAS containing tetraethyl lead.	Fuel disposed of in former borrow pit.
10	Southeast Open Disposal Area (A) (landfill)	South Field, southeast area	1965–1975	Construction and demolition debris, waste solvents, paint, oils, hydraulic fluid, PCBs, pesticides, and herbicides.	Secondary disposal area during this period; site covers about 4 acres.
11	Southeast Open Disposal Area (B) (landfill)	South Field, southeast area	1943–1970	Construction and demolition debris, waste solvents, paint, oils, hydraulic fluid, and PCBs.	Secondary disposal area during this period; site covers about 3 acres.
12	Tetraethyl Lead Disposal Area (waste pile)	South Field, southeast area	May 1, 1968	Tank-bottom sludge and fuel filters contaminated with tetraethyl lead.	Disposal area posted with warning; site consists of two earth-covered mounds; 25-foot by 25-foot area.
13	Sanitary Landfill (landfill)	South Field, southeast area	1979–1984	Refuse, waste solvents, paint, hydraulic fluids, and asbestos.	Primary sanitary landfill that potentially received hazardous wastes the first year of operation.

TABLE 2-2

SUMMARY OF POTENTIAL DISPOSAL SITES
WORK PLAN FOR
SITES 5, 7, 29, 35, 38, 39, 40, AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 3

Site No.	Site Name and Type	Location	Period of Operation	Types of Material Disposed of	Comments
14	Short-Term Sanitary Landfill (landfill)	South Field, southeast area	1978–1979	Refuse, waste solvents, oils, paint, and hydraulic fluids.	Primary sanitary landfill for brief period; relocated due to drainage problems.
15	Southwest Landfill (landfill)	South Field, southwest area	1965–1979	Refuse, waste paints, oils, solvents, thinners, asbestos, and hydraulic fluid.	Primary landfill for this time period; covers about 15 acres.
16	Open Disposal and Burning Area (landfill)	South Field, southwest area	1943–1965	Refuse, waste paints, oils, solvents, thinners, PCBs, and hydraulic fluid.	Primary disposal area for this time period; covers about 10 acres.
17	Crash Crew Training Area (contaminated soil)	North Field, west side	1951–1991	JP-5 fuel.	Waste fuels and some solvents ignited, then extinguished.
18	Crash Crew Training Area (contaminated soil)	North Field, west side	1951–1991	JP-5 fuel.	Waste fuels and some solvents ignited, then extinguished.
29	Auto Hobby Shop	Area around Building 1404	1943–present	Paint, oils, and solvents.	Abandoned underground waste oil tanks.
30	South Field Maintenance Hangar	Area around Building 1406	1943–present	Fuels, solvents, and oils.	Abandoned underground waste oil tanks.
31	Sludge Drying Beds and Disposal Areas	Wastewater Treatment Plant and along perimeter road	1943–1990	Wastewater Treatment Plant sludge.	Sludge from beds spread on ground along perimeter road.
32	North Field Maintenance Hangar	Area around Building 1424	1943–present	Fuels, solvents, and oils.	Abandoned underground waste oil tanks.
33	Midfield Maintenance Hangar	Area around Building 1454	1943–present	Fuels, solvents, and oils.	Abandoned underground waste oil tanks.
35	Public Works Maintenance Facility, Building 1429	Industrial Area, Building 1429	1943–present	Fuel, soil, solvents.	A service station with a pump island and seven USTs was formerly at this site. The station was used for maintenance of vehicles and equipment. Three USTs were abandoned in 1984.
36	Auto Repair Booth, Building 1440A	Industrial Area, Building 1440A	1943–to early 1980s	Oil, grease, fuel, and solvents.	Site was used as auto repair booth and has a UST located on the east side of the building.

TABLE 2-2

SUMMARY OF POTENTIAL DISPOSAL SITES
WORK PLAN FOR
SITES 5, 7, 29, 35, 38, 39, 40, AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 3 OF 3

Site No.	Site Name and Type	Location	Period of Operation	Types of Material Disposed of	Comments
37	Paint Spray Booth, Building 1486	Industrial Area, Building 1486	1943–present	Paint and solvents.	This building contained a furniture shop and paint spray booth. Fumes from the painting operations were captured and combined with water, then discharged to the sanitary sewer.
38	Golf Course Maintenance Building, Building 2877	Northeast Perimeter Road, golf course	Unknown to 1994	Metals, solvents, grease, and pesticides.	Battery reconditioning was conducted in this building until 1979. Pesticides were also stored and mixed in the building until 1983.
39	Clear Creek Floodplain	Southwest Perimeter Road	Unknown	Potential solvents, oil, and fuel.	Storm water has been discharged to the area, and rusted drums were found in the floodplain in 1992.
40	Basewide Groundwater	Basewide – includes site specific & multi-site plumes	1940's to present	All materials previously mentioned	Groundwater both from specific sites and the entire base are included in this site
PSC 1485C	Pesticide Storage Building	Area around former Buuilding 1485C	Unknown to 1980's	Storage area for pesticides and nursery chemicals	Building burned to ground in 1980's. No investigation done to date.

Notes: AVGAS – aviation gasoline
JP-5 – jet propellant 5
PCB – polychlorinated biphenyls
UST – underground storage tank

investigations to enable detailed alternative selection and evaluation of proposed remedies.

Recognizing the process is both slow and expensive, USEPA sought to encourage flexibility in the program through the SACM program (USEPA 1992a). SACM encourages early action or development of ways to focus the RI/FS parts of an investigation, especially for certain types of sites with similar characteristics such as contaminated groundwater or VOCs in soil. The goal of SACM is to accelerate the entire remedial process.

Based on information acquired from evaluating and remediating previous Superfund sites, the presumptive remedy approach, which is one acceleration tool within SACM, has been developed by USEPA (USEPA 1993b). Presumptive remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection within the Superfund program. The use of presumptive remedies can streamline or focus the site investigation and remedy selection, reducing the cost and time required to clean up the site.

For the Site Assessments at Sites 5, 38 and PSC 1485C at NAS Whiting Field USEPA's *Guidance for Performing Site Inspections Under CERCLA* (USEPA 1992) will be used.

For the RI of Sites 7, 29, 35, 39, and 40 at NAS Whiting Field, USEPA's presumptive remedy strategy presented in *Final Guidance: Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites* (USEPA 1996a) and *Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with Volatile Organic Compounds in Soils* (USEPA 1993a) will be used. The presumptive remedies for removal of volatile organic compounds (VOCs) from soil are soil vapor extraction (SVE), thermal desporption, and incineration. The key strategy elements for remediating contaminated groundwater sites include those listed below.

- Site characterization should be coordinated with response actions, and both should be implemented in a phased approach.
- Early or interim actions should be used to reduce site risks and to provide additional site data.
- Site characterization and interim action data should be used to assess the likelihood of restoring groundwater to ARARs or risk-based cleanup levels.
- Restoration potential should be assessed before establishing objectives for the long-term remedy.

- Provisions for monitoring and evaluating the performance of all groundwater actions should be included.

- Groundwater response actions should generally be implemented in more than one phase.

- Post construction refinements will generally be needed for long-term remedies.

During the investigations, information will be collected to evaluate both the presumptive remedies for removal of VOCs from soil and for restoration/treatment of contaminated groundwater. Both active (e.g., pump and treat) and passive (e.g., natural attenuation) groundwater remedial alternatives will be evaluated because it may be necessary to apply active remedial technologies to the plume source areas and passive remedial technologies to restore the aqueous plume.

The steps presented below lead to identification of the most probable conditions and account for reasonable deviations for the site that are to be used during design and implementation. Monitoring and contingent actions to take if deviations are detected are also identified.

1. Planning sessions are conducted to sort through issues, review existing data, and screen possible remedial actions and technologies. A work plan is developed to give direction to the subsequent investigation and analyses.

2. Information is gathered to determine general site conditions and to refine the nature and extent of contamination. Investigations are complete when it is possible to determine probable conditions (including associated risk), differentiate among alternatives, set monitoring requirements, and identify reasonable deviations. Probable site conditions are those most likely to occur. Reasonable deviations are other potentially valid interpretations of site conditions.

3. The most probable site conditions and reasonable deviations are established. Based on identification of these conditions, conceptual designs incorporating both a base action and a contingent action can be developed and a Record of Decision (ROD) can be signed. The selected alternatives will identify probable technology performance and reasonable deviations from that performance.

4. Following remedy selection, remedial designs based on the most probable site conditions plus designs covering contingencies for the agreed-upon reasonable deviations are produced.

5. Parameters to detect deviations during construction and operation of remedial actions will be selected. Key indicators (chemical, physical, and others) are selected for observation during remediation for both expected and reasonable-deviation conditions. The selected parameters are measured, and necessary modifications (contingent action) are made if deviations occur. Decisions on changes to the remedial action are made on the basis of the detected deviations, then contingent actions are developed.

This proposed approach recognizes complete site characterization is not possible or necessary and, therefore, the remaining uncertainties must be managed. This approach emphasizes the collection of data only to support decisions. At all of the referenced Sites, because of the presumptive remedies proposed, the primary decisions will be to determine (1) if free-phase dense, nonaqueous-phase liquids (DNAPLs) are present in the subsurface and, if they are present, whether they can practicably be removed; (2) the measures necessary to contain the groundwater plume (i.e., whether natural attenuation is sufficient to contain and restore the aqueous plume in a reasonable time frame); and (3) whether soil in the vadose zone poses an unacceptable risk to human health and the environment or a risk to groundwater (i.e., through leaching of contaminants) and, if so, the actions needed to remediate the soil. To make these decisions, data must be available to support a human health risk assessment, a qualitative ecological risk evaluation, and an FS.

The following investigation strategies will be applied to the media surrounding Sites 5, 7, 29, 35, 38, 39, 40, and PSC 1485C to provide confidence that potential contamination has been identified and to verify the conceptual site model (CSM) for groundwater and subsurface soil.

- Soil and groundwater data will be collected near hot spots, potential migration pathways, at Sites with identified groundwater standards exceedances (primary and secondary), and suspected source areas to fill data gaps identified during pervious investigations. This data collection will be performed to identify and quantify soil and groundwater contaminants in potential source areas, and at existing sites.

- At select locations both near the boundaries of the facility, and also at suspected groundwater plume boundaries, where contamination is considered to be present at low concentrations, additional monitoring wells will be installed and groundwater data will be collected to define the horizontal and vertical extent of contamination with more certainty.

- Monitoring wells installed below the "sand and gravel clay layer" to the top of the Pensacola clay will be electronically logged (including gamma, SP, and resistivity) to provide correlation data.

When practicable, a minimum of 10 samples (per medium), considered by USEPA to be a minimum for upper confidence limit (UCL) calculation based on the normal or lognormal distributions, will be collected. If data are not distributed in normal or lognormal fashion, a nonparametric (distribution-free) statistic, the approximate 95-percent UCL for the median, will be used.

2.7 DATA NEEDS EVALUATION

2.7.1 Conceptual Site Model

The CSM is a framework within which the environmental pathways of potential concern are identified and illustrated. The media to be sampled to evaluate whether a release has occurred can be identified from the model. The CSM also serves as a framework for conceptualizing response actions. The CSM includes a set of hypotheses about the contaminated media and environmental pathways selected on the basis of existing data and understanding of the site. The source areas are identified as the areas of suspected waste disposal. A contaminant release mechanism is defined as a process that results in migration of a contaminant from a source area into the immediate environment. Once in the environment, contaminants can be transferred between media and transported away from the source and/or site.

Figure 2-5 illustrates the various media, transport pathways, and exposure pathways that could be affected by release of the source material. This model represents current and predicted future conditions at the site, assuming the site remains an industrial area. In the CSM, a distinction is made between probable conditions and reasonable deviations. For the most part, data collected will be used to characterize the current nature and extent of contamination to support the human and ecological risk assessments and the FS.

Contamination at the facility includes commingled trichloroethene (TCE) and combined benzene, toluene, ethylbenzene, and xylene (BTEX) groundwater plumes as well as VOCs, polynuclear aromatic hydrocarbons (PAHs), and potentially, inorganics in soil. The CSM identifies the three probable release mechanisms for contaminants described below.

- Spills and leaks. Human and ecological receptors may come in contact with contaminated material and be exposed by dermal contact or incidental ingestion. Potential human receptors are construction workers, trespassers, future residents, and site occupational workers.

- Leaching to groundwater. Contaminants can leach from contaminated soil into the groundwater. Both military and future residents as well as occupational workers could be exposed to the groundwater by ingestion, dermal contact, and inhalation because the potable water source for NAS Whiting Field is groundwater pumped from on-base wells that draw water from the affected aquifer. The potable water produced by NAS Whiting Field is currently treated using granular activated carbon (GAC) to remove contaminants, if present.

- Gravity drainage of DNAPLs to groundwater. Contaminants can dissolve from free-phase DNAPLs (if present) that have flowed through the soil profile down into the groundwater. Residents and occupational workers could be exposed to the groundwater by ingestion, dermal contact, and inhalation because the potable water source for NAS Whiting Field is groundwater pumped from on-base wells. The potable water produced by NAS Whiting Field is currently treated using GAC to remove contaminants, if present.

The exposure potential of these contaminated media is discussed in Section 5.0, Baseline Risk Assessment.

2.7.2 Preliminary Identification of Remedial Action Technologies

The identification of preliminary remedial action technologies requires the identification of applicable or relevant and appropriate requirements (ARARs), remedial action objectives (RAOs), and probable treatment technologies.

2.7.2.1 Applicable or Relevant and Appropriate Requirements

ARARs must be identified and complied with to determine the appropriate extent of the required remedial action, develop remedial action alternatives, and direct the remedial action. The NCP and Section 121 of SARA specify that remedial action for cleanup of hazardous substances must comply with requirements or standards under federal or more stringent state environmental laws that are ARARs to the hazardous substances or particular circumstances at a site. NAS Whiting Field is classified as an NPL site;

therefore, the identification of ARARs will follow CERCLA guidance to ensure strict conformance with regulatory criteria.

Applicable requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances found at a CERCLA site" [55 FR 8814, March 8, 1990 (NCP)]. Examples of applicable requirements include cleanup standards and standards of control for a hazardous substance.

Relevant and appropriate requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility siting law that, while not (legally) applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (55 FR 8814). For example, the Maximum Contaminant Levels (MCLs) promulgated under the Safe Drinking Water Act would be considered relevant and appropriate at a site where surface or groundwater contamination could affect a potential (not actual) drinking-water source.

Requirements under federal or state law may be either applicable or relevant and appropriate to CERCLA cleanup actions, but not both; however, requirements must be both relevant and appropriate for compliance to be required. For cases in which federal and state ARARs are available, or when there are two potential ARARs addressing the same issue, the more stringent requirements must be met.

In the absence of federal- or state-promulgated regulations, there are other criteria, advisories, guidance values, and proposed standards that are not legally binding, but that may serve as useful guidance for setting protective cleanup levels. These are not potential ARARs, but are "to-be-considered" guidance.

Tables A-1 presented in Appendix A of this Work Plan are preliminary compilations of potential federal and state ARARs, of which subsets will be used or to which additional ARARs will be added as site-specific contaminants are identified and remedial actions are evaluated during the FS. The ARARs are characterized as: chemical-, location-, and action-specific ARARs.

- "Chemical-specific requirements set health- or risk-based concentration limits or discharge limitations in various environmental media for specific hazardous substances, pollutants, or contaminants" (55 FR 8814). These requirements generally set protective cleanup levels for the chemicals of potential concern (COPCs) in the designated media or indicate a safe level of discharge that may be incorporated when considering a specific remedial activity.

- Location-specific requirements "are restrictions placed upon the concentration of hazardous substances or the conduct of activities solely because they are in special locations. Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats" (53 FR 51437, proposed NCP, 1988).

- Performance, design, or other action-specific requirements set controls or restrictions on particular kinds of activities related to the management of hazardous waste (55 FR 8814). Selection of a particular remedial action at a site will invoke the appropriate action-specific ARARs that may specify particular performance standards or technologies as well as specific environmental levels for discharge or residual chemicals.

The list of ARARs in Appendix A was used for the development of the probable remedial actions required at the Sites covered by this investigation.

2.7.2.2 Preliminary Remedial Action Objectives

Preliminary Remedial Action Objectives (RAOs) were identified through the development of the CSM and the preliminary list of ARARs for Sites 5, 7, 29, 35, 38, 39, 40 and PSC 1485C. The intent of the RAOs is to determine the specific media, contaminants, and probable exposure pathways that must be addressed through a remedial action to protect the public and environment. These RAOs were developed to protect the public and environment for both existing and future site conditions as presented by the CSM. Under CERCLA guidance, RAOs required to protect the public health and environment are calculated based on the list of COPCs detected in the media, the corresponding acceptable exposure levels calculated on a cumulative basis, and the exposure routes. During the RI evaluation these criteria will be used to establish specific maximum allowable concentrations for each COPC detected during the investigation.

The probable contaminated media are surface and subsurface soil and groundwater. The probable exposure pathways include direct contact or incidental ingestion of surface soil by a trespasser, future resident (adult and child), or site occupational worker; dermal contact with, ingestion of, or inhalation of contaminated soil by a construction worker; and dermal contact, ingestion, or inhalation associated with residential or occupational use of groundwater. The only potentially contaminated media requiring remedial action are the groundwater, surface soil, and subsurface soil. A detailed description of the current and future land use exposure pathways and receptors proposed for evaluation at Sites 5, 7, 29, 35, 38, 39, 40 and PSC 1485C is included in Section 5.1.3.2.

The likely COPCs for Sites 5, 7, 29, 35, 38, 39, 40 and PSC 1485C include VOCs, PAHs, and inorganics. Based on the list of ARARs, probable contaminated media, and exposure pathways, specific RAOs for each of the COPCs will be developed for the sites and presented within the FS; however, general RAOs have been assumed based on probable exposure pathways to support the development of the RI sampling requirements and contingent actions. The RAOs for Sites 5, 7, 29, 35, 38, 39, 40 and PSC 1485C include:

- Limit dermal contact, incidental ingestion, and inhalation of soil by containment (maintain concrete cover) or treatment.
- Prevent exposure to contaminated media above acceptable risk levels.
- Initiate source control to prevent further spread of the aqueous plume, and restore the maximum aerial extent of the aquifer to those cleanup levels appropriate for beneficial uses.
- Reduce, to the extent practicable, the free-phase DNAPL zone, if present, and control further migration of subsurface DNAPLs to the surrounding groundwater.

Because removal of DNAPLs from the subsurface is often not practicable and no treatment technologies are currently available that can attain ARARs where subsurface DNAPLs are present, restoration of the aquifer in the DNAPL zone in a reasonable time frame may not be attainable (USEPA, 1996a). For this reason, an ARAR waiver due to technical impracticability may be appropriate for the DNAPL sites at NAS Whiting Field.

2.7.2.3 Preliminary Remedial Action Technologies

Potential remedial response actions that meet the RAOs have been identified for NAS Whiting Field Sites 5, 7, 29, 35, 38, 39, 40 and PSC 1485C. These response actions are based on the CSM and on USEPA guidance on presumptive remedies for sites with contaminated groundwater (USEPA 1996a) and VOCs in soils (USEPA 1993a). The presumptive remedies listed by USEPA in these documents are based on an historical evaluation of the most commonly implemented and effective remedial technologies included in RODs for CERCLA sites with similar contaminants. Based on the existing site data, the preliminary remedial actions fall into the following general categories:

- Land use controls
- Soil treatment or containment
- Aqueous groundwater plume containment/treatment
- Groundwater source (DNAPLs, if present) containment/removal

The potential remedial actions are discussed in the following paragraphs:

Land Use Controls. These controls include the implementation of land use restrictions for specific areas and can include limitations on intrusive activities such as trenching and well installation. Controls may also require well-head treatment on potable water supply and irrigation wells and may specify monitoring and maintenance requirements. Other limited actions that might be required are the installation of fencing and warning signs around a site.

Soil Treatment or Containment. Treatment or containment of contaminated soil may be required for several of the source areas. Potential remedial actions include in-situ SVE, and excavation and treatment by thermal desorption or incineration. Containment of the contaminated soil by the existing concrete pavement is assumed to adequately limit exposure at several of the sites.

Aqueous Groundwater Plume Containment/Treatment. Natural attenuation, which is defined in the NCP as "biodegradation, dispersion, dilution, and adsorption" of contaminants, is assumed to be able to effectively reduce contaminants in the aqueous groundwater plume to levels protective of human health. If site-specific data indicate natural attenuation will not effectively contain and treat the groundwater, extraction wells with ex-situ treatment may be employed to hydraulically control the migration of the contaminant plume. Potential ex-situ treatments will include air stripping, carbon adsorption, and biological treatment, among others.

Groundwater Source Containment/Removal. Free-phase DNAPLs, if present, will be removed to the extent practicable using extraction wells or other similar technology. Because free-phase DNAPLs have not been found during previous investigations at NAS Whiting Field, it is not anticipated DNAPLs will be identified during this investigation. If free-phase DNAPLs are not found, hydraulic containment of the source areas with high concentrations through the use of extraction wells may be a feasible method of controlling plume migration.

These potential remedial actions technologies include several process options are shown on Figure 2-6. Additional technologies and process options may be evaluated in the FS, based on information collected during the RI. Development and evaluation of remedial alternatives are discussed in Section 8.0 of this Work Plan.

2.8 TREATABILITY STUDIES/PILOT TESTING

Potential remedial technologies for contaminated soil and groundwater may require treatability studies and/or pilot testing to determine their effectiveness and applicability under existing site conditions. At the present time, no treatability studies or pilot testing are proposed for investigation activities at Sites 7, 29, 36, 38, 39, 40 and PSC 1485C.

The need for treatability studies and/or pilot testing will be re-evaluated following completion of data validation/evaluation and the initial evaluation of remedial technologies. Existing site data, available literature, and case studies will be explored before treatability studies are recommended. Treatability studies, if proposed, would be used to determine the site-specific suitability of the technologies and provide operational data to evaluate the technology during the FS.

2.9 SUMMARY OF DATA NEEDS

The purposes for collecting data at Sites 7, 29, 36, 38, 39, 40 and PSC 1485C are to:

- Verify the probable conditions and reasonable deviations (i.e., verify the CSM and nature and extent of contamination).
- Support the human health risk assessment and ecological evaluation.
- Determine if an additional investigation (RI) needs to be conducted at Site 38 and PSC 1485C. and
- Support the FS at Sites 7, 29, 36, 39 and 40.

Only those probable conditions and reasonable deviations that will affect the outcome of the risk assessment, the need for additional investigation, and evaluation or the FS will be identified.

To determine the data to be collected during the investigation, uncertainties in terms of probable conditions and reasonable deviations have been identified with respect to technology performance (Table 2-3) and site conditions (Table 2-4). Preliminary base actions and contingent actions to address the deviations have also been identified. To resolve unacceptable uncertainties with respect to site conditions, technology performance, and regulatory issues, data needs are identified in Tables 2-3 and

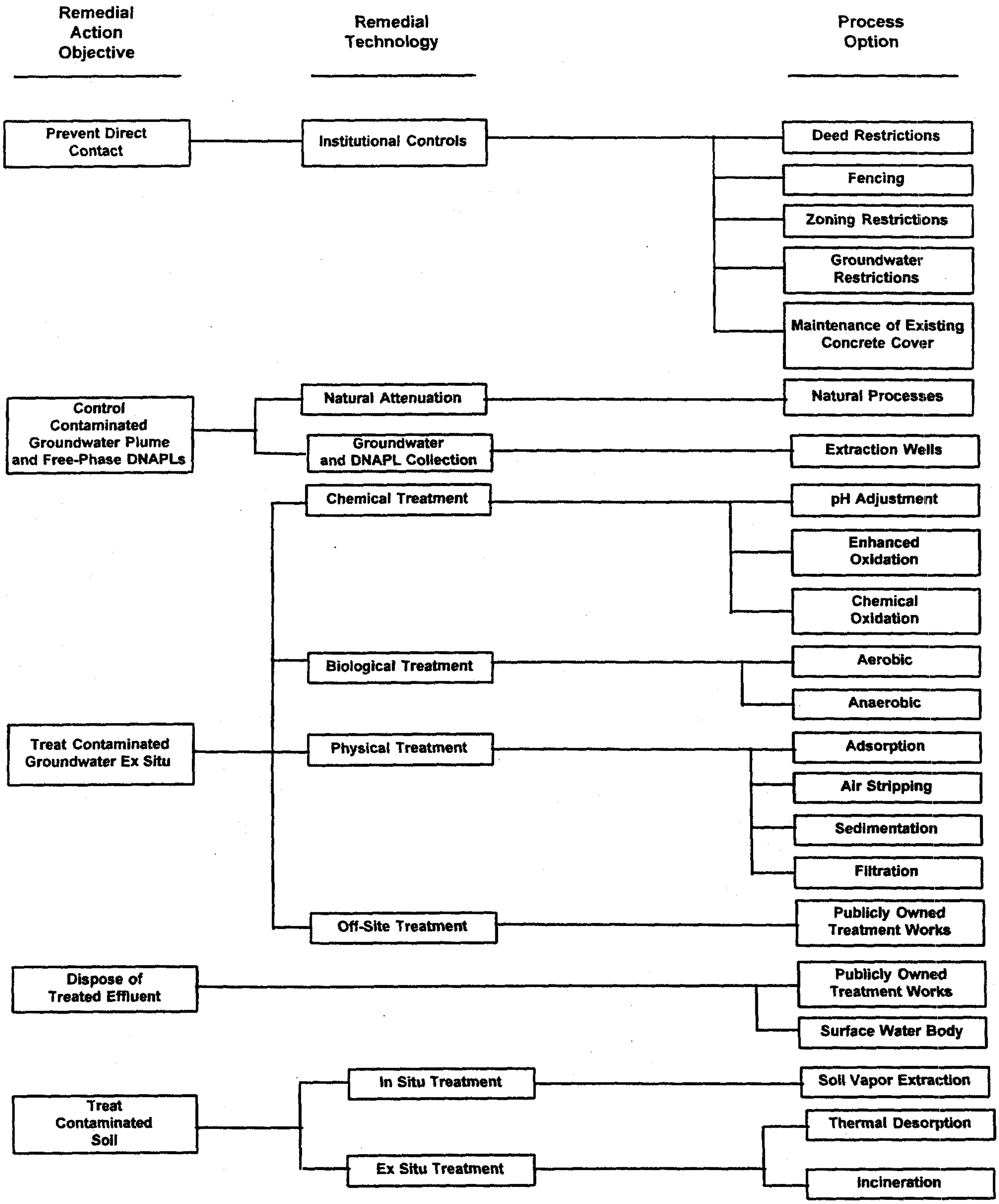


Figure 2-6

PRELIMINARY REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

TABLE 2-3

TECHNOLOGY PERFORMANCE UNCERTAINTIES
WORK PLAN FOR
SITES 5, 7, 29, 35, 38, 39, 40, AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA

Technology	Probable Conditions	Data Needs	Potential Deviation	Contingent Action	Additional Data Needs
Land Use Controls	Implementation of land use controls for future land use provides for soil and groundwater restrictions.	Determine regulatory requirements for implementation of land use controls.	Groundwater and land use controls are not implemented that restrict future use of groundwater and maintain existing concrete and asphalt pavements in industrial areas.	Potable water supply may need to be provided to area residents, and contaminated soil beneath existing concrete and asphalt pavements may require treatment.	Characterization of groundwater and soil necessary to evaluate human health and ecological risks and to evaluate potential treatment technologies.
Soil Containment or Treatment	Soil treatment may be required as a result of exceeding leachability values or discovery of a potential source area.	Verify/determine nature and extent of contamination at all sites. Assess soil properties and lithology to evaluate soil treatment technologies.	Soil treatment or containment is required at sites with existing asphalt or concrete cover.	Assess soil properties and lithology at all sites with unacceptable human health or ecological risk. Pilot tests may be required to design treatment or containment systems.	Soil properties and treatment system parameters such as air permeability, air flow rates, influent concentrations, etc., that are necessary to design soil treatment systems.
Groundwater Source (DNAPLs) Containment/ Removal	A free-phase DNAPL groundwater source is not found or, if a source is found, removal of the DNAPLs may not be practicable.	Investigate the groundwater near the suspected release area to identify free-phase DNAPLs. If free-phase DNAPLs are found, perform pilot test to see if DNAPLs can practicably be recovered.	Free-phase DNAPLs are found in the soil or groundwater near the suspected release area, and they can practicably be removed.	Based on pilot test data, design either a DNAPL recovery system or groundwater extraction system to reduce downgradient migration of the DNAPL source area.	Characterization of the free-phase DNAPL plume. DNAPL and groundwater extraction rates, contaminant concentrations, etc., will be required for design of a treatment system.
Aqueous Groundwater Plume Containment/ Treatment	The aqueous plume migrates downgradient toward Clear Creek. Engineering controls and natural attenuation may be used to contain the plume.	Determine groundwater chemistry parameters necessary to evaluate redox conditions and microbial processes (Chapelle List) and hydrologic parameters required to model groundwater flow and design groundwater containment/treatment system.	Natural attenuation prevents further migration of the aqueous plume, and other treatment technologies are not required to prevent migration of the plume.	Long-term monitoring will be required to demonstrate natural attenuation effectiveness.	No additional data required.

DNAPL–dense, nonaqueous-phase liquid

TABLE 2-4

SITE CONDITION UNCERTAINTIES AND DATA NEEDS
WORK PLAN FOR
SITES 5, 7, 29, 35, 38, 39, 40, AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA

Media	Probable Conditions	Base Action	Data Needs	Reasonable Deviation	Contingent Action	Additional Data Needs
Surface and Subsurface Soil	Soil at multiple Sites may require treatment or removal as a results of exceeding leachability requirements. SPLP tests will clarify the problem areas and help in determining the level of remediation needed..	Treat or contain surface soil as needed. Maintain existing concrete or asphalt pavement at as many sites as possible.	Verify nature and extent of contamination at all sites, and collect/evaluate soil air permeability data and soil lithology data.	Existing concrete and asphalt pavement will not be maintained, requiring soil treatment at one or more sites.	Evaluate treatment and containment alternatives for all sites	Collect/evaluate soil air permeability data and soil lithology data required to design soil containment or treatment systems.
Groundwater	Implementation of engineering controls and natural attenuation is required to contain the aqueous groundwater plume. No free-phase DNAPLs are found.	Monitor chemical and natural attenuation groundwater parameters. Perform groundwater modeling necessary to design engineering controls.	Hydrologic and groundwater data to model and design a system to contain the groundwater plume. Groundwater chemistry parameters necessary to evaluate redox conditions and microbial processes (natural attenuation list).	Migration of the aqueous groundwater plume is controlled by natural attenuation, and engineering controls are not required.	Long-term monitoring will be required to demonstrate the effectiveness of natural attenuation.	No additional data required.
Biota	Biota does not pose a risk to human health or terrestrial fauna because of the soil cover and current and future land uses.	No action.	Ecological survey and nature and extent of surface soil & sediment contaminants.	Terrestrial fauna are being exposed to contaminated materials, thereby producing a possible ecological risk.	Prevent fauna and flora exposure to contaminated material by capping or removal actions.	No additional data required.

2-4. These data needs are consolidated with existing information to identify what data should be collected during the RI.

The information listed below will be collected during the RI.

- Soil. Surface and subsurface soil samples will be collected from hot spots and suspected source areas to determine the nature and extent of contamination and to fill in data gaps identified during previous investigations.

- Groundwater. Groundwater quality data and hydrologic information from previous investigations, sampling of existing monitoring wells, and installation of monitoring wells will be used to evaluate the nature and extent of groundwater plumes; to evaluate the hydrogeologic environment at the facility; and to facilitate possible groundwater modeling. This information will be used to support the site assessment conclusions, the risk assessment and the FS.

- Biota. An ecological characterization will be conducted in areas impacted by and surrounding Sites 5, 7, 29, 35, 38, 39, 40 and PSC 1485C. This information will support the qualitative ecological risk evaluation. The ecological investigation at Site 39 will also include toxicity testing, and a biological survey.

Background concentrations of constituents have been determined during previous investigations at NAS Whiting Field. A statistical evaluation of the background data set may be conducted by the Navy to determine if site-specific background samples need to be collected.

2.10 PROJECT DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) are qualitative or quantitative statements developed by the data user to specify the quality of data needed from a particular data activity to support specific decisions. The DQOs are the starting points in the design of an investigation. The DQO development process matches sampling and analytical capabilities to the data targeted for specific uses and ensures the quality of the data satisfies project requirements. USEPA has identified five general levels of analytical data quality as being potentially applicable to field investigations under CERCLA at potential hazardous waste sites. The Navy has adopted three of the analytical levels as quality control (QC) requirements. They are C, D, and E, which correlate to Levels III, IV, and V described in *Data Quality Objectives for Remedial Response Activities Development Process* (USEPA 1987). These levels are based on the type of site to be investigated, the level of accuracy and precision required, and the intended use of the data. Analytical requirements for USEPA Levels I and II have not yet been defined by the Navy.

A brief description (as presented in *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program*, Energy Systems 1988) of each level is provided below.

USEPA Level I: Field Screening. This level of data quality is the lowest, but provides the most rapid results. It is used to assist in the optimization of sampling locations and for health and safety support. Data generated provide information on the presence or absence of certain constituents and are generally qualitative rather than quantitative.

USEPA Level II: Field Analysis. This level of data quality is characterized by the use of analytical instruments that are carried in the field and the use of mobile laboratories. Depending on factors such as instrumentation and environmental matrix, data may be either qualitative or quantitative.

Navy Level C QC. A site requiring Level C QC would be a site near a populated area, not on the NPL, and not likely to be undergoing litigation. Level C QC includes review and approval of the laboratory quality assurance (QA) plan and of the site Work Plan. The laboratory must successfully analyze a performance sample, undergo an audit, correct deficiencies found during the audit, and provide monthly progress reports on QA. The laboratory that performs Level C QC must have passed the performance sample furnished by the Superfund Contract Laboratory Program (CLP) in the past year. The laboratory does not need to be receiving CLP bid lots of samples. Level C allows the use of non–CLP methods, but requires the methods be accepted USEPA methods or be equivalent to such methods. The Navy audit and performance samples are required in addition to any specified by the USEPA Superfund Program.

Navy Level D QC. Level D QC is to be used for sites that are on or about to be on the NPL. These sites are typically near populated areas and are likely to undergo litigation. Level D QC includes review and approval of the laboratory QA plan, the site Work Plan, and the field QA plan. The laboratory must successfully analyze a performance sample, undergo an audit, correct deficiencies found during the audit. These activities will be administered and evaluated by the Navy Energy and Environmental Support Activity Contract Representative. This audit and the analysis performance sample are in addition to those related to the USEPA Superfund Program. The laboratory that performs Level D QC must have successfully analyzed the performance sample furnished through the Superfund CLP and must be able to generate CLP deliverables. For a Level D site, CLP methods are used and the CLP data package is generated. The Navy audit and performance samples are required in addition to any specified by the USEPA Superfund program.

Navy Level E QC. A site requiring Level E QC will be located away from a populated area, will not be an NPL site, and will have a low probability of litigation. Level E QC includes review and approval of the laboratory QA plan and the site Work Plan. The laboratory must successfully analyze a performance sample, undergo an audit, correct deficiencies found during the audit. For Level E, the laboratory is not required to have successfully analyzed a CLP performance sample. Level E allows the use of non–CLP methods, but requires all methods used must be USEPA or equivalent.

Specifics regarding QA/QC, validation, and uses of each level of data are described in the Navy's *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program* (Energy Systems 1988) and *Navy Installation Restoration Laboratory Quality Assurance Guide* [Naval Facilities Engineering Service Center (NFESC) 1996] and in the USEPA Office of Emergency and Remedial Response and Office of Waste Programs Environmental Enforcement Guidance's *Data Quality Objectives for Remedial Response Activities Development Process* (USEPA 1987).

At NAS Whiting Field, which is an NPL site, Data Quality Level D is intended for most laboratory sample analyses. Table 2-5 summarizes the analytical parameters, DQOs, and data use for each task to be undertaken during RI activities at NAS Whiting Field.

TABLE 2-5

**DATA QUALITY OBJECTIVES
WORK PLAN FOR
SITES 5, 7, 29, 35, 38, 39, 40, AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA**

Activity	Objectives	Data Quality Objective	
		QC Level	Rationale
Groundwater & Surface Water Analysis	Data will be used to characterize and define extent of groundwater and surface water contamination.	D	Data necessary for Human Health Risk Assessment and Feasibility Study
Soil Analysis (surface soil, sediment, and subsurface soil)	Data will be used to evaluate exposure potential and to characterize and define the extent of soil contamination.	D	Data necessary for Human Health Risk Assessment, Ecological Risk Assessment, and Feasibility Study
Receptors Survey	Data will be used to establish potential receptors.	II	Data mandatory for Ecological Risk Assessment
Air Survey	Health and safety breathing space monitoring	I	Health and Safety

3.0 TECHNICAL APPROACH

3.1 FIELD INVESTIGATION METHODS

The planned work for the Facility-wide Groundwater Investigation (Site 40), the Clear Creek investigation (Site 39), and the site-specific investigations (Sites 7, 29, and 36) focuses primarily on confirming and defining the extent of surface-water contamination and the lateral and vertical extents of soil contamination and groundwater plumes previously investigated. Analysis of the previous investigation data suggests additional data are needed to define the concentrations of constituents in soil and groundwater to regulatory-defined or risk-based concentrations and to improve the certainty of data interpretation in support of the FS engineering analysis and design. Additionally, Site Assessments at three sites (Site 5, 38 and PSC 1485C) will determine if an RI/FS needs to be conducted at these sites.

The Scope of Work (SOW) has been planned based on a review of the existing data, regulatory guidance [e.g., FDEP Soil Cleanup Guidance, USEPA Risk Assessment Guidance for Superfund (RAGS) and addenda], and in consultation with USEPA, FDEP, and Navy personnel. Adjustments to the planned SOW may be necessary, however, as new data become available. If new field investigation methods or changes to existing methods become necessary as a result of adjustments to the SOW, then the proposed revisions will be presented by TtNUS to the Southern Division's Remedial Project Manager, FDEP and USEPA Region IV regulatory representatives, and NAS Whiting Field's Environmental Coordinator for review and approval.

3.1.1 Standard Operating Procedures

A variety of field investigation activities will be conducted at NAS Whiting Field to meet the objectives of the Site Assessments and RI/FS. To ensure all data are consistent with regulatory requirements and meet the DQOs, all data collection activities will primarily follow the Standard Operating Procedures (SOPs) issued by the QA Section of the FDEP *Comprehensive Quality Assurance Plan (COMPQAP)* (DEP-QA-001/92, TtNUS 1998) and secondarily the USEPA in *Environmental Investigations Standard Operating Procedures Quality Assurance Manual* (1996b). As such, all activities will comply with TtNUS's FDEP COMPQAP #980038 (1998).

In some instances the planned investigation activities (e.g., well construction) may not be specifically addressed in the COMPQAP; in other cases a methodology presented in the COMPQAP, or a specific step thereof, may be deemed inconsistent with site-specific conditions or previous investigation methods used at NAS Whiting Field. In these cases the USEPA Region IV Environmental Investigations SOPs (USEPA 1996b), Navy technical guidance, or project-specific SOPs adopted by or prepared by TtNUS will be invoked.

A copy of all above-referenced guidance documents along with this Work Plan will be maintained in the TtNUS field office at NAS Whiting Field and will be reviewed with the field team before work begins. Project-specific SOPs that are adopted by or prepared by TtNUS for the investigation at NAS Whiting Field are presented in this Work Plan and are discussed in the following sections.

3.1.2 General Site Operations

3.1.2.1 Field Team Organization

The TtNUS field team will consist of staff members who will be assigned temporary duty at NAS Whiting Field and who will conduct the field investigation activities. The organization of the field team is described below.

- The Field Operations Leader (FOL) is responsible for the day-to-day direction of personnel in the field. The FOL will assign tasks to field team personnel, direct the sequence of activities, coordinate with NAS Whiting Field personnel, coordinate subcontractors, and review tasks in progress and those completed. The FOL will ensure project-specific plans are implemented and activities are in compliance with appropriate guidelines.

- The Project Safety Officer is responsible for ensuring proper health and safety procedures are identified and implemented for the project and project-related health and safety incidents are properly investigated. In the event only a small number of project staff are required on site, the duties of the Project Safety Officer may be assigned to the FOL or another member of the field team. The Project Safety Officer or designee will report directly to the TtNUS Corporate Director of Health and Safety.

- The Field Geologist will oversee soil boring and monitoring well installation activities and may conduct various environmental sampling activities. Duties will include logging and documentation of drilling and well construction, environmental sample collection and handling, and ensuring the approved methods are implemented. The field geologist may also conduct tests for identifying subsurface conditions and characterizing the groundwater flow regime.

- The Sampling Personnel will be responsible for properly locating, collecting, preserving, packaging, documenting, and shipping environmental samples to the laboratory.

3.1.2.2 Mobilization

TtNUS must perform several internal tasks before the field mobilization. These tasks include the following:

- Preparation of technical and subcontractor bid specifications
- Selection and mobilization of subcontractors
- Acquisition and preparation of equipment for transportation to the field
- Acquisition and preparation of expendable supplies for transportation to the field
- Arrangement of transportation and lodging for field personnel

In addition to internal efforts, external mobilization efforts will be coordinated with the NAS Whiting Field Point of Contact (POC). A list of the steps to be taken includes the following:

- Set up the investigation field office and coordinate utilities hookup (if necessary).
- Select staging areas for equipment and IDWs.
- Select decontamination area(s) with electrical hookup, potable water, and drainage to an oil/water separator.
- Complete security procedures for project and subcontractor personnel to gain access to the Facility.
- Ensure supplies of potable water are accessible.
- Coordinate with Base personnel to locate buried utilities.

A location will be assigned by the Base POC to be used as a personnel/communication field office. Multiple decontamination facilities may be selected or constructed by the drilling subcontractor before the beginning of field activities at locations deemed appropriate by the Base POC and TtNUS.

Site reconnaissance will be performed before initiation of field activities. Some of these activities will be performed with the assistance of NAS Whiting Field personnel. These activities are listed below:

- Locating and setting up of decontamination facilities.
- Identifying the potable water source(s), electrical outlets, and other utilities to be used during field activities.
- Collecting and shipping to the laboratory a field blank of the potable water source to be used for field decontamination activities.
- Locating temporary storage for soil cuttings and purge/development water drums as well as solid wastes generated during field activities (e.g., Tyvek™ suits, gloves, plastic sheeting).
- Reconnoitering and marking/staking sample locations.
- Locating underground and aboveground utilities within the work areas (including water, gas, sanitary sewer lines, drainage lines, telephone cable, and electric lines). Electric lines may be shielded, if necessary.
- Erecting any necessary barricades and/or temporary fencing.

3.1.3 Field Investigation Activities

The planned SOW for the field investigation activities includes the following general categories of field investigation activities:

- Collection of surface soil samples.
- Collection of surface water, sediment, and streambed groundwater samples.
- Installation of soil borings and collection of subsurface soil samples using direct-push or conventional drilling techniques.

- Installation of groundwater monitoring wells in the perched groundwater zone and in the shallow and deep zones of the alluvial aquifer.
- Collection of groundwater samples.
- Measurement of groundwater potentiometric level.
- Field measurement of physical and chemical properties of soil and groundwater samples.
- Decontamination of investigation equipment.
- Sample management.
- Field QC, documentation, and record keeping.
- IDW management.
- Location survey.

As described in Section 3.1.1, all field investigation activities will be performed in accordance with the appropriate regulatory and project-specific SOPs. Project-specific SOPs will be given priority, followed by the FDEP COMPQAP and then USEPA Region IV SOPs when SOPs for the same task differ. Copies of all guidance documents will be located in the TtNUS field office at NAS Whiting Field. Table 3-1 presents a cross-reference guide to the applicable SOPs for the general field activities listed above. Table 3-1 focuses on the SOPs deemed most likely to be used by the field investigation team. If activities arise that are not referenced in Table 3-1, then the project-specific SOPs, COMPQAP, the USEPA Region IV SOPs, or Navy guidance will be invoked (in indicated order) with approval by USEPA, FDEP, and Navy personnel. Project-specific SOPs referenced in Table 3-1 are discussed in the following sections.

3.1.3.1 Direct-Push Sampling

A direct-push technology (DPT) soil-sampling device (e.g., Geoprobe® system) may be used to obtain subsurface soil samples at NAS Whiting Field. Unlike conventional drilling techniques, DPT probing tools do not create an open borehole into which soil sampling devices are inserted. DPT allows investigators to push a closed sampler to depth, open the sampler, and obtain a discrete soil sample that is relatively undisturbed. For this project a DPT sampler may be used for collecting shallow soil samples (typically less than 30 feet).

TABLE 3-1

STANDARD OPERATING PROCEDURES CROSS REFERENCE[a]
RI/FS WORK PLAN FOR
SITES 5, 7, 29, 35, 38, 39, 40 AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA

ACTIVITY		FDEP[b]		EPA-4[c]		Tetra Tech NUS[d]	
SOIL SAMPLING							
	General	A	4.0 / 4.3.1-4.3.2	A	12.3		
	Manual Sampling	A	4.3.4	A	12.3.1		
	Power-Driven Sampling	A	4.3.4.5	A	12.3.2		
	VOC Samples	A	4.3.2	A	5.13.9 / 12.4.1		
	Sample Mixing	A	4.3.2	A	5.13.8		
DRILLING							
	Safety			A	6.7		
	Direct-Push					A	3.1.3.1
	Augering			A	6.3.1		
	Rotary			A	6.3.3		
	Abandonment			A	6.9		
WELL CONSTRUCTION							
	Overdrilling			A	6.4.2		
	Annular Space			A	6..4.1		
	Casing and Screen			M	6.6.2	A	3.1.3.2
	Installing the Well			M	6.5.1 / 6.5.2		3.1.3.3
	Filter Pack			A	6.4.3 / 6.6.3		
	Filter Pack and Screen Design			M	6.6.4	A	3.1.3.4
	Well Seal and Grouting			A	6.4.4 / 6.4.5		
	Surface Completion			A	6.4.6 / 6.4.7 / 6.4.8		3.1.3.3.4
	Development			A	6.8		3.1.3.3.6
	Temporary Wells			A	6.1		
GROUNDWATER SAMPLING							
	General	A	4.0 / 4.2.1 / 4.2.5.2				
	Purging		4.2.5.3-4.2.5.5	A	7.2.1 / 7.2.2 / 7.2.4		
	Sample Methods		4.2.5.6	A	7.3.1 / 7.3.3		
	Sample Containers / Preservation	A	4.2.2	A	7.3.4		
	Trace Organic and Metals	A	4.2.5.6 (g)	M	5.13.7 / 7.3.5	A	3.1.3.5
	Temporary Wells	A	4.2.9				
	Auxillary Data			A	7.3.7		
FIELD MEASUREMENTS							
	Groundwater Levels	A	4.2.5.4	M	15.8	A	3.1.3.6
	pH, Temperature, Conductivity	A	7.5.2 / 7.5.3 / 7.5.5	A	16.2-16.4		
	Dissolved Oxygen	A	7.5.4	A	16.7		3.1.3.11
	Turbidity			A	16.5		
	Redox Potential					A	3.1.3.7
	Ferrous Iron (Fe++)					A	3.1.3.8
	Air Monitoring / Head Space	A	7.5.7			A	3.1.3.9
	Residual Product Detection					A	3.1.3.10

TABLE 3-1

STANDARD OPERATING PROCEDURES CROSS REFERENCE[a]
RI/FS WORK PLAN FOR
SITES 5, 7, 29, 35, 38, 39, 40 AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 2

ACTIVITY	FDEP[b]		EPA-4[c]		Tetra Tech NUS[d]	
DECONTAMINATION						
General	A	4.1.1 / 4.1.3				
Reagents	A	4.1.2				
Sampling Equipment	A	4.1.4			A	3.1.3.3.8–9
Filters	A	4.1.6				
Tubing	A	4.1.7.1-4.1.7.5				
Pumps	A	4.1.8				
Field Equipment	A	4.1.9.1 / 4.1.9.2			A	3.1.3.3.10
Analyte-Free Water Containers	A	4.1.10				
Ice Chests / Shipping Containers	A	4.1.11				
SAMPLE HANDLING						
General			A	5.13.3 / 5.13.7		
Sample Containers	A	4.4.1				
Preservation and Holding Times	A	4.4.2	A	5.13.6		
Documentation	A	5.0 / 5.3	A	3.3		
Sample Identification	A	5.3.2	A	3.2.1	A	3.1.12
Packing and Transportation	A	4.4.3.2				
FIELD QUALITY ASSURANCE/QUALITY CONTROL						
Field Calibration	A	7.5				
Field Equipment Decontamination		7.5..1				
Quality Control Samples	A	9.1				
Control Limits	A	7.5			A	3.1.13
Corrective Action	A	11			A	3.1.14
INVESTIGATION-DERIVED WASTE						
Investigation Waste Disposal	A	4.4.5	A	5.15 / 5.15.1	A	3.1.15
Nonhazardous Waste			A	5.15 / 5.15.2		
Hazardous Waste				5.15 / 5.15.3		
RECORDKEEPING						
Field Logbooks and Forms			A	3.5	A	3.1.16
Manufacturer's Specifications					A	3.1.17
Chain-of-Custody Forms	A	5.3				
Field Calibration Records	A	7.8				
SURVEYING						
GPS Surveys					A	3.1.18
NGVD Surveys					A	3.1.18

(a) Annotations found in this reference table indicate the following:
A – Standard Operating Procedure (SOP) that is fully adopted.
M – Modification of existing Florida Department of Environmental Protection (FDEP) or U.S. Environmental Protection Agency (EPA) SOP documented in project-specific SOP.

(b) Denotes FDEP SOPs adopted by Tetra Tech NUS, source:
FDEP Comprehensive Quality Assurance Plan #98038, August 1889.
Number shown indicates the chapter and section in the FDEP SOPs.

(c) Denotes EPA Region 4 Environmental Investigations SOPs and Quality Assurance Manual, May 1996. Number shown indicates the section in the EPA SOPs.

(d) Denotes project-specific SOPs adopted by or prepared by Tetra Tech NUS for the conduct of work at Naval Air Station Whiting Field.
Number shown indicates the text section in which the SOP may be found.

GPS – Global Postioning System
NGVD – Natural Geodetic Vertical Datum
VOC – volatile organic compound

The samples may be collected from any discrete depth interval, but will typically be used above the zone of perched groundwater saturation. The DPT sampler usually has an inner diameter of 1 to 2 inches and recovers a soil core measuring 2 to 4 feet in length. If deemed necessary, liners made of material compatible with the contaminants of interest will be used inside the soil sampler to keep the sample intact after it is extruded from the sampler and to reduce the likelihood of cross-contamination or false-positive laboratory results.

To collect a sample the DPT sampler is attached to the leading end of the pushing rods and driven in a closed and sealed position into the subsurface soil using an hydraulic and/or percussion driver. At the top of the desired sampling interval, the pushing is temporarily stopped and an internal-release mechanism in the sampler is triggered using extension rods inserted down the inside of the push rods. After the release is activated, the sampler is again driven forward, collecting soil in the sample tube as a piston retracts. The probe assembly is then retrieved and the soil sample is removed for examination.

After removal from the sampler barrel, the sample is extracted and placed on a fresh, clean surface. If a liner is used, it is separated into four 6-inch-long sections, and the exposed soil is screened with a flame ionization detector (FID). Samples selected for laboratory analyses will be immediately placed into laboratory-supplied containers. The samples will be labeled, preserved on ice, and transported to the laboratory. All portions of the probe assembly that are inserted into the ground will be decontaminated before each use using standard decontamination procedures (see Table 3-1). An equipment rinsate blank will be collected from the decontaminated sampler at the prescribed frequency.

3.1.3.2 Well Casing and Screen Materials

All permanent and temporary monitoring wells will be constructed of Schedule 40 polyvinyl chloride (PVC) casing and screen manufactured for environmental and meeting the requirements of the American Society for Testing and Materials (ASTM) F 480 and D 1785. This variance from the USEPA Region IV SOPs' requirement for stainless steel casing and screen materials is based on previous investigation results that show background groundwater quality (e.g., pH) and dissolved contaminants in groundwater (e.g., petroleum hydrocarbons) are not present at concentrations detrimental to the use of polyvinyl chloride (PVC). Furthermore, the use of PVC will make the construction of these wells consistent with that of wells previously installed at NAS Whiting Field. If conditions are encountered for which PVC is inappropriate, then stainless steel or an other suitable material will be selected and presented to USEPA, FDEP, and Navy personnel for approval before being used.

3.1.3.3 Monitoring Well Installation

3.1.3.3.1 Perched and Shallow Well Installation

The perched and shallow wells will be drilled by either hollow-stem auger (HSA) or mud rotary, dependent on field conditions. The wells will be constructed of 2-inch-diameter, Schedule 40 PVC, flush-threaded casing with 15-feet, 0.01-in. slotted, PVC screens. The well screens will be placed such that the screens bracket the water table. If HSA drilling is used, the wells will be constructed inside the auger. Once the screen and riser pipe are in place, the annulus of the boring will be backfilled with clean, 20/30, silica sand from the bottom of the borehole to 2 feet above the top of the screen. If the well is constructed inside augers, the sand will be maintained at a depth of several inches inside the augers to ensure an adequate sand pack around the well. A fine sand seal at least 4 feet thick, will be installed on top of the 20/30 silica sand. The remainder of the annulus of the borehole will be grouted by pumping a cement/bentonite slurry through a tremie pipe up to 2 feet below land surface (bls).

3.1.3.3.2 Deep Monitoring Well Installation

Deep monitoring wells are proposed for two separate investigation depths. The first investigation depth is to the top of the sand-and-gravel clay unit at approximately -65 feet mean sea level (MSL). The second investigation area is the top of the Pensacola Clay at approximately –150 feet MSL.

Monitoring wells completed to the top of the sand-and-gravel clay unit will be constructed of 4-inch-diameter, Schedule 40 PVC, flush-threaded casing with 10-feet, 0.01-inch slotted, PVC screens. Centralizers will be placed at approximately 25-foot intervals above the top of the screen and at the bottom of the screen to ensure the well is centered in the borehole. The annulus between the well and the borehole wall will be backfilled using a tremie pipe with 20/30 clean silica sand to at least 2 feet above the top of the screen. A 4-foot-thick fine sand seal will be installed above the sand pack. The remainder of the annulus will be backfilled with cement/bentonite grout.

At monitoring well locations where the overlying groundwater is documented to be contaminated, an 8-inch diameter PVC surface casing will be installed seal off the upper portion of the aquifer to prevent carry-down of possible contaminants to its lower sections. The surface casings will be set in confining layers below the bottom of the confirmed contamination. The casings will be pressure-grouted in place and allowed to cure for at least 24 hours before the borehole is advanced below the casing.

The monitoring wells completed to the top of the Pensacola Clay unit will be constructed as indicated for the deep wells above, however all of the wells will be surface cased using a minimum 8-inch diameter PVC surface casing. The surface casing will be completed a minimum of 2 feet into the sand-and gravel clay unit to isolate the unit and prevent carry-down of possible contaminants to the lower unit.

3.1.3.3.4 Well Surface Completion

The surface completion of the monitoring wells may be constructed by aboveground completion methods. Wells constructed aboveground will have galvanized steel or aluminum protector casing with a diameter at least 4-inches greater than the diameter of the well riser. Each aboveground completion will have a 3-foot x 3-foot x 5-inch concrete pad sloping away from the steel casing. The bottom of the pad will be 2 inches bls. Four 5-foot-long, 4-inch-diameter guardposts or concrete car stops will be installed at the corners (sides for concrete car stops) of each monitoring well head pad. Each post will be recessed 2 feet into the ground and set in concrete. Each will be installed outside the surface pad. The steel protective casing will be painted with exterior enamel paint. Well identification will be permanently marked on the well lid and protective casing.

When requested by the NAS Whiting Field POC, surface completions will be flush with the ground. The well riser will be cut approximately 3 inches bls. A freely draining valve box (or equivalent) with a locking cover shall be placed over the well head. The top of the well riser will be at least 1 foot above the bottom of the box. The box lid will be centered in a 3-foot x 3-foot, 5-inch-thick concrete pad sloping at 0.25 inch/foot away from the box. If the pad is expected to have heavy traffic passing over it, steel-reinforcing bars will be used. Concrete curbs may be installed at each side of the concrete pads adjacent to high traffic areas. Well identification will be permanently marked on the box lid and casing cap (if possible).

3.1.3.3.5 General Drilling Requirements

The only drilling fluids used will be potable water or drilling mud. The drilling mud will carry a chemical analysis from the manufacturer. In addition, lubricants used on the rig will not introduce or mask chemicals of concern (COCs) at the site being investigated. All trash, waste, grout, cuttings, and drilling fluids associated with the drilling activities will be disposed of by the drilling subcontractor in accordance with the NAS Whiting Field IDW Management Plan (Appendix D).

The items listed below will also be part of the SOP for drilling.

- All data related to well construction will be documented on a monitoring well sheet (Appendix B-2).
- Each well will be constructed by a driller and drilling company certified by the State of Florida.
- Well locations will be approved by the Base POC before installation.
- Glue will not be used to join screen or casing.
- At each well nest location, the deep well will be installed first to prevent invasion of drilling fluids into the shallower wells.
- A notch will be cut into the top of the casing to be used as a reference point for the elevation survey and for measuring water levels.

3.1.3.3.6 Well Development

Monitoring wells will be developed to remove fine-grained sediments and to break down the filter cake or smearing along the borehole well. The preferred method of development will be surging alternating with pumping. All development equipment will be decontaminated before being placed in the well. Throughout the development procedure, discharge water color and volume shall be documented. Wells will be developed until the following criteria are achieved:

- A minimum of three well volumes will be removed during well development.
- Turbidity remains within a 10 nephelometric turbidity unit (NTU) range for 2 consecutive readings.
- Stabilization of the following parameters occurs.
  - temperature plus or minus 1°C
  - pH plus or minus 1 unit
  - electrical conductivity plus or minus 5 percent of scale

- Accumulated sediment is removed from the well.

In general, the following will be conducted or considered during the well development process:

- Development will begin no sooner than 24 hours after well installation;
- If drilling mud is used during drilling, the total drilling fluid volume will be removed; and
- No detergents, bleaches, soaps, or other such items will be used to develop a well.

After development and after the water levels have been allowed to stabilize a minimum of 24 hours, the static water level will be measured and recorded. All data related to well development, including alternate development methodologies and their justification, will be written on the well development sheet (Appendix B-2) or in the field logbook.

3.1.3.3.7 Decontamination Procedures

The decontamination of major equipment (e.g., drilling rigs, dump trucks, backhoes) and sampling equipment is necessary to minimize the spread of contamination to clean zones, to reduce exposure to personnel, and to reduce cross-contamination of samples when equipment is used at more than one sampling location.

Major equipment will be decontaminated in the existing NAS Whiting Field vehicle wash rack. Sampling equipment will be decontaminated in tubs or drainage pans so solvents can be collected and disposed of properly. Rinsate samples will be collected, as required, from the decontaminated sampling equipment by rinsing the clean equipment with analyte-free water. The sampling equipment will then be wrapped in aluminum foil and stored in a clean area until use. Clean sampling equipment will not be allowed to come into contact with the ground or any potentially contaminated surfaces before use at the sampling location.

Disposable material (e.g., gloves, Tyvek™ suits) generated during decontamination will be bagged and stored in drums for proper disposal at an off-base location.

3.1.3.3.8 Soil Sampling Equipment

All stainless steel spoons, bowls, and other soil-sampling equipment will be decontaminated after each use. The decontamination procedure outlined below will be used.

- Wash and scrub the equipment with a solution of Liquinox™ (or equivalent) and potable water.
- Rinse with potable water.
- Rinse non-steel equipment with 10 to 15 percent reagent-grade nitric acid ($HN0^3$) when sampling for trace metals.
- Rinse with analyte-free water.
- Rinse twice with isopropanol.
- Rinse with analyte-free water.
- Air dry (if possible).
- Wrap in oil-free aluminum foil (if appropriate).

3.1.3.3.9 Water Sampling Equipment

Submersible, bladder, and peristaltic pumps may be used to purge and collect water samples. Submersible pumps will be cleaned inside and outside between uses at each sampling location. Peristaltic pumps will use new Teflon™ tubing at each sampling location. Pump decontamination procedures are as follows:

- Wash with Liquinox™ and potable water
- Rinse with potable water
- Rinse with analyte-free water

Bailers will be decontaminated after each use. Stainless steel or Teflon™-coated lines will be dedicated to each well for each sampling event or will be decontaminated between uses. Equipment will be decontaminated in the manner outlined below.

- Wash and scrub equipment with a solution of Liquinox™ (or equivalent) and potable water.
- Rinse with potable water.
- Rinse non-steel equipment with 10 to 15 percent reagent-grade $HN0^3$ when sampling for trace metals.
- Rinse with analyte-free water.
- Rinse twice with isopropanol.

- Air dry (if possible).
- Wrap in oil-free aluminum foil.

Any additional equipment used in sampling will be decontaminated by following the procedure outlined above.

3.1.3.3.10 Major Equipment

Between each well or boring, all major equipment used for sample collection such as drill rigs and backhoes will be decontaminated at the existing NAS Whiting Field vehicle wash rack. Decontamination will consist of steam-cleaning, washing with Liquinox (or equivalent), and rinsing with potable water. If necessary, surfaces will be scrubbed until all visible soil and possible contaminants have been removed. All dirt, grime, grease, oil, loose paint, and rust flakes shall be removed. The inside surfaces of the casing, drill rods, and auger flights will be similarly cleaned. The decontamination area will be constructed and operated to contain all solids and liquids produced. Liquids will be directed to an oil/water separator before release to the Base's sanitary sewer system. Solids will be retained and tested to determine appropriate disposal.

3.1.3.4 Filter Pack and Screen Design

The USEPA Region IV SOPs (USEPA 1996b) require the filter pack used for monitoring well annular space be selected based on grain size analysis of the formation interval adjacent to the well screen interval. This guidance will be followed during RI for aquifer zones where previous investigations have analyzed the formation intervals of interest and for which the grain size data are available. When this information is not available, well construction will follow the previous investigation practice of using a 20/30-size gradation filter material coupled with a 0.010-inch, machine-slotted well screen. This filter pack size and screen slot size combination has previously been used at NAS Whiting Field in the sand-and-gravel aquifer, and groundwater samples of acceptable quality have been obtained.

The 20/30 filter size is compatible with a formation that has a D30 size (i.e., 30 percent finer by weight than the D30 sieve size) in the range of fine sand. If visual inspection of the drill cuttings or split-spoon samples indicates the D30 size of the formation is significantly coarser than this range (e.g., uniform medium to coarse sand and/or gravel), then an alternate filter pack and screen slot size combination will be recommended in accordance with the USEPA Region IV SOPs (USEPA 1996b).

3.1.3.5 Trace Metals Sampling in Groundwater

Groundwater samples to be analyzed for trace levels of inorganics will be collected in a manner consistent with the procedure developed USEPA Region IV SOP guidance. The monitoring wells will be purged and sampled using low-flow/low-stress techniques. Efforts will be made to reduce the groundwater turbidity below 10 NTUs. Filtered groundwater samples will not be collected.

3.1.3.6 Groundwater Level Measurements

Measurement of the depth to water in monitoring wells will be performed according to the COMPQAP and USEPA Region IV SOPs, with the exception that measuring devices will not be calibrated against a steel surveyor's chain. All devices used during a given measuring event will, however, be calibrated against each other to ensure accurate relative measurements are made during the data collection event. The results of the calibration will be recorded in the field logbook.

A minimum of one complete round of water level measurements will be obtained from existing monitoring wells and the monitoring wells installed during the investigation. All measurements will be collected within a 48-hour period of consistent weather conditions to minimize atmospheric/precipitation effects on groundwater conditions. Measurements will be collected at least 24 hours after well development using an electronic water level indicator. A permanent reference point on the top of each well casing will be used for determining the depth to water. Water level measurements will be recorded in the field logbook to the nearest 0.01 foot. Static water levels will be measured in each well before any fluid is withdrawn. If floating hydrocarbon is detected in the monitoring wells, the thickness of the free product will be measured with an electronic interface probe.

3.1.3.6 Oxidation-Reduction Potential of Groundwater

The oxidation-reduction (Redox) potential of groundwater will be measured to support an evaluation of the potential for natural attenuation of organic contaminants in groundwater. Redox potential will be determined in the field using a portable field meter at selected monitoring wells. Because of the sensitivity of Redox potential to oxygenation and disturbance of the groundwater sample, care will be used to obtain the sample, and the analysis will be performed at the well head immediately after sample collection.
Calibration and maintenance of the Redox meter will be performed in accordance with the manufacturer's instructions. These actions will be documented in the field logbook and/or on an equipment calibration log as presented in Appendix B-2.

3.1.3.8 Ferrous Iron in Groundwater

The concentration of ferrous iron (Fe++) in groundwater will be measured to support an evaluation of the potential for natural attenuation of organic contaminants in groundwater. Ferrous iron will be determined in the field at selected monitoring wells using a field test kit. Because of the sensitivity of the iron valence state to oxygenation and disturbance of the groundwater sample, care will be used to obtain the sample, and the analysis will be performed at the well head immediately after sample collection.

Use of the field test kit will be performed in accordance with the manufacturer's instructions. These actions will be documented in the field logbook and/or on the appropriate field forms as required by the SOPs (see Table 3-1).

3.1.3.9 Sample Head Space Analysis

Soil vapor head space analyses will be performed according to the method prescribed in FDEP Rule 62-770.200(2) of the Florida Administrative Code (FAC). Soil samples will be analyzed for total organic vapors using an organic vapor analyzer (OVA) equipped with a FID. Charcoal filters will be used to differentiate between methane (a naturally occurring gas) and total organic vapors. The calibration of the FID will be checked before the analyses. A photoionization detector (PID) may be used only after a determination of the instrument's equivalent response to a FID has been made. The following steps will be used to prepare soil samples for head space analysis:

- Each soil sample to be analyzed will be equally split and placed into 2 clean, 16-ounce glass jars.
- Each sample jar will filled to approximately one-half of its volume, if sufficient sample volume is available.
- Aluminum foil covers will be sealed over the open end of the glass jar using a threaded, metal ring.
- The sample jars will be allowed to equilibrate under a temperature range of 20–30°C for approximately 5 minutes.
- The headspace will be measured by piercing the aluminum foil with the FID probe and recording the highest sustained reading.

- If FID readings above background are detected in the first jar, the second sample jar will be measured using an in-line charcoal filter to determine the portion of the total reading attributable to methane gas.

3.1.3.10 Residual Free Product Detection in Soils

Residual-free-product field detection techniques using ultraviolet (UV) light or red dye will be used for soil borings and monitoring wells installed near suspected DNAPL source areas. UV light or red dye field tests will be performed on soil samples collected from the top of significant clay layers (greater than 4 feet thick) and other suspected locations based on field observations (i.e., elevated FID readings, odors, staining). Some petroleum-based, light nonaqueous-phase liquid (NAPLs) and some solvent-based DNALPs will fluoresce when exposed to UV light. Other NAPLs that may not fluoresce may be detected by mixing the soil sample with a colored, hydrophobic dye and watching for the presence of colored NAPL.

When a UV light is used to detect NAPLs, the suspect soil sample will be placed in a light-tight box containing a UV light. The box will be equipped with a shaded viewing port to eliminate ambient light, and the sample reaction will be directly observed for the presence of fluorescence. Alternatively, a darkened, well-ventilated room equipped with a UV light may be used if conveniently located near the sample collection site.

When samples are to be dye-tested, a portion of the suspect soil (e.g., 8-ounces volume, if available) will be placed into a clear, 1-liter jar. A volume of potable water and Red Oil (commercially available low-toxicity dye) sufficient to create a separate liquid phase following mixing (i.e., approximately 16 ounces) will be added to the sample, and the mixture will be agitated for a sufficient time to desegregate the majority of the soil sample. Following mixing the jar will be allowed to sit and will be observed for the presence of a colored NAPL fraction. Because of their natural cohesiveness, clay-rich samples may not readily desegregate, and mechanical breakage of the sample before mixing may be necessary.

Since high concentrations of contaminants are anticipated in the samples described above, health and safety precautions [e.g., increased level of personal protective equipment (PPE)] will be carefully selected to prevent exposure of the observers and surrounding public.

3.1.3.11 Dissolved Oxygen in Groundwater

Dissolved oxygen (DO) in groundwater will be measured to support an evaluation of the potential for natural attenuation of organic contaminants. DO will be measured using a DO meter or Digital Titrator/Modified Wrinkler (Hach Kit Model Number OX-DT). In general, the digital titrator method will be used to measure low levels of DO (less than approximately 0.5 mg/L), while a DO meter will be used to measure higher DO concentrations. Digital titrator and DO meter analyses will be performed in accordance with the manufacturers' instructions. Because titration results are based on color change and, therefore, are somewhat operator-dependent, the same person will generally perform all titration analyses during a sampling round.

Care will be exercised to avoid entrainment of atmospheric oxygen or loss of DO in groundwater samples. Shallow water samples (collected less than 5 feet below the water surface) should be collected using a DO Dunker (APHA–type)) or a bailer. Deeper water samples should be collected using a Kemmerer-type sampler or low-flow peristaltic or bladder pump.

DO meter analyses will be performed by placing the probe in a 300-mL biochemical oxygen demand flask or other similar container and then slowly overfilling (three volumes minimum) it using a tube connected to the sampler. The fill tube will extend to the bottom of the container to prevent turbulence.

3.1.3.12 Laboratory Sample Identification

The sample identification system to be used in the field to identify each sample taken during RI will be in accordance with TtNUS SOP CT-O4, contained in Appendix B-3. The coding system provides a tracking record to allow the retrieval of information about a particular sample and to ensure each sample is uniquely identified.

Each sample is assigned a series of codes indicating the site (e.g., WHF-32), sample type, sample location, sample depth, and sample round (i.e., sequential order or date). The sample nomenclature system has been designed to maintain consistency between field, laboratory, and database sample numbers. In addition, the system facilitates cost-effective data evaluation because data can be easily sorted by matrix and/or depth or by other such parameters.

3.1.3.13 Field Instrument Control Limits

QA/QC specifications for field measurements are summarized in Table 3-2. This table shows the control parameters to be assessed, control limits, and corrective actions to be implemented.

The TtNUS representative on site at each well and boring will confirm measurements of total depth of holes, dimensions and placement of well screens and casings, and volume and placement of filter pack and grout materials by independent observation or measurement. The FOL will review field forms and field logbook entries for indications of measurement data outside of the control range.

3.1.3.14 Corrective Actions

Comprehensive QA activities will be conducted by TtNUS to ensure the data obtained from the sampling program as well as the resultant work products are technically valid. Any staff member engaged in project work who discovers or suspects a nonconformance is responsible for identifying and segregating (if applicable) the nonconforming item as well for forwarding a report to the Task Order Manager and QA Manager for investigation and corrective action. The QA Manager has the responsibility for assuring the overall adequacy of corrective actions and summarizing this information in a status report to TtNUS management.

Before its use in the field, each instrument will be calibrated to ensure it is capable of producing usable data indicative of site conditions. While in the field, QC data, such as duplicate field measurements or QC check standards, will be collected for field instruments and used to evaluate the continued acceptable performance of each instrument. Table 3-2 lists corrective actions to be implemented whenever field instruments fail to meet the established control limit criteria.

Field data will be reviewed by the site geologist while in the field. Extreme readings (i.e., readings that appear significantly different from other readings at the same site) will be accepted only after the instrument has been checked for malfunction and the readings have been verified by retesting (with an alternate instrument, if possible).

QC data obtained from field duplicates, field blanks, trip blanks, or equipment blanks will be collected while in the field and assessed by the QA Manager or the cognitive Task Order Manager to evaluate the overall quality of the sample collected. Whenever the results of the field QC samples fail to meet the acceptance criteria, as identified in Table 3-2, corrective actions will be initiated.

TABLE 3-2

FIELD QA/QC SPECIFICATIONS
RI/FS WORK PLAN FOR
SITES 5, 7, 29, 35, 38, 39, 40 AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA

Analysis	Control Parameter	Control Limit	Corrective Action
Air monitoring using an organic vapor analyzer (FID)	Daily check of calibration of FID	Calibration to manufacturer's specifications	Recalibrate. If unable to calibrate, replace.
pH of water	Continuing calibration check of pH 7.0 buffer	pH = 7.0 ± 0.1	Recalibrate. If unable to calibrate, replace electrode.
Specific conductance of water	Continuing calibration check of standard solution	± 1% of standard	Recalibrate.
Temperature of water	Check against NIST precision thermometer	± 0.1°C at two different temperatures	Reset thermistors in accordance with manufacturer's specifications; dispose of inaccurate thermometer.

FID – flame ionization detector
NIST – National Institute of Standards and Technology

Potential corrective actions will be dependent upon the final use of the data; however, appropriate corrective actions may include the following, as determined by the Task Order Manager in conjunction with the QA Manager:

- Evaluation of the suspect QC data by comparison to other QC samples taken at the same site or on the same date or analyzed by the same equipment/technician for similar contamination.
- Reanalysis of the QC sample in question (if possible).
- Qualification of the results.
- Resampling.

Non–TtNUS parties involved in identified nonconformances will be notified initially by telephone with a follow-up formal correspondence explaining the deficiency. The responsible outside parties will be required to investigate the nonconformance and offer an appropriate corrective action. Notification, tracking, and ultimate closure of reported nonconformances and the review/approval of submitted corrective actions will be the responsibility of the TtNUS QA Manager.

3.1.3.15 Investigation-Derived Waste

All IDW generated during RI activities will be handled and disposed of in accordance with the *Revised Investigation-Derived Waste Management Plan* (ABB-ES 1996a). IDW management is discussed in Section 6.0, and a copy of the management plan is included in Appendix D.

3.1.3.16 Field Logbooks and Forms

Field logbooks and standard data collection forms will be completed for field investigation, sample description, and data collection activities. These will include sample log sheets (for soil and groundwater samples), a daily record of drilling activities, and equipment calibration logs. An example of these forms can be found in Appendix B-2.

The sampling event leader shall maintain a bound, weatherproof field logbook. The FOL or designee will record all information related to sampling or field activities. This information may include sampling time, weather conditions, unusual events (e.g., well tampering), field measurements, descriptions of photographs, or other such details.

A site logbook shall be maintained by the FOL. The requirements of the site logbook are outlined in SOP SA-6.3, attached in Appendix B-4. This book will contain a summary of the day's activities and will reference the field logbooks when applicable.

Each field team member who is supervising a drilling subcontractor must complete a daily record of drilling activity. This form documents the stage, hours, methods, materials, and supplies used during daily drilling activities. The information contained on this form is used for billing verification and progress reports. The driller's signature is required at the end of each working day to verify work accomplished, hours worked, standby time, and material used. An example of this form is provided in Appendix B-2.

At the completion of field activities, the FOL will submit to the Task Order Manager all field records, data, field logbooks, site logbooks, chain-of-custody receipts, sample log sheets, drilling logs, daily logs, and other such forms.

3.1.3.17 Manufacturers' Specifications

The FOL shall collect a copy of the available manufacturers' specifications for all supplies and equipment that are used in the collection of environmental samples. This shall apply to, but not be limited to, the following:

- Calibration gases
- Sample containers
- Decontamination solvents and detergents
- Laboratory-grade/analyte-free water
- Reagents
- Drilling additives
- Bentonite and cement
- Filter pack materials
- Well casing and screen
- Disposable bailers, filters, tubing.

The manufacturers' specifications will be included in the project files at the end of the field mobilization.

3.1.3.18 Surveying

3.1.3.18.1 Global Positioning Survey Locations

The locations of sample points, soil borings, and wells may initially be determined during the field investigation using a portable Global Positioning Survey (GPS) instrument with sub-meter accuracy. This information may be helpful in plotting results and analyzing the data coverage in real-time to make data acquisition decisions during RI. The GPS instrument will be used in accordance with the manufacturer's instructions, and the results will be recorded in the field records. Monitoring wells and other selected points, however, will be permanently located using a NGVD survey at the close of the field mobilization.

3.1.3.18.2 National Geodetic Vertical Datum Survey Locations

The locations of monitoring wells installed during RI/FS will be measured by a certified land surveyor. Each point will be measured from a reference location that is tied to the Florida State Plane Coordinate System. An X–Y coordinate system shall be used to identify locations. The X coordinate will be the east–west axis; the Y coordinate will be the north–south axis. The reference location will be the origin.

All surveyed locations will be reported using the Florida State Plane Coordinate System. Existing installation benchmarks will serve as the horizontal and vertical datums for the survey. Elevations and horizontal locations will be recorded to the nearest hundredth of a foot. The elevations of all monitoring wells will be surveyed at the water level measuring reference point on the top of the well casing and on the undisturbed ground surface adjacent to the well pad.

3.2 SITE-SPECIFIC RI/FS ACTIVITIES

The technical approaches to all of the individual tasks constituting the field investigation are described in the following sections.

3.2.1 Site 5: The Battery Acid Seepage Pit

3.2.1.1 Site 5 History

On February 9, 1984, Florida Department of Environmental Regulation (FDER) conducted a hazardous waste compliance inspection at NAS Whiting Field. Shortly there after FDEP issued a warning notice to the Navy stating that the "battery electrolyte and/or wastes constituents and that the disposal of hazardous waste constituted violations of Florida Administrative Code Chapters 17-4 and 17-30 and Chapter 403, Florida Statues." [Geraghty & Miller (G&M), 1985].

The battery shop (Building 1478) had been the site of waste acid and electrolyte solution disposal from 1967 until 1984. Waste solutions with sodium bicarbonate and tap water were poured down the drain of a sink in the building which, discharged to a dry well west of the building. The dry well consisted of a section of 60-inch-diameter concrete culvert set vertically in the ground and filled with gravel. The sink drain was disconnected from the dry well in 1984 and connected to the sanitary sewer. An estimated 180 gallons of waste electrolyte solution was discharged to the dry well annually during the period of operation [Envirodyne Engineers Inc. (EE), 1985].

Originally Building 1478 was called the Old Transformer Repair Shop and from the 1940's until 1964 the building was used for electrical transformer repair. Transformers were reportedly drained of dielectric fluid possibly containing polychlorinated biphenyls (PCBs) which discharged into the grassed "0-2" ditch located approximately 500 feet southeast of the Old Transformer Repair Shop. Based on this disposal method the "0-2" ditch was designated Site 6 and investigated as part of the Installation Restoration Program (EE, 1985).

Based on a meeting attended by the Navy, FDER and G&M, G&M prepared for the Navy a document entitled "Proposed Monitoring Program for the Battery Shop". The final edition of the document was completed June 1985. Site 5 the Battery Acid Seepage Pit was included in the Initial Assessment Study completed by Envirodyne Engineers in 1985.

In June 1985, G&M began the field investigative work at the Battery shop site. Four soil borings were completed and subsurface soil samples were collected at 5-foot intervals. One soil boring was completed to a depth of 85 feet below land surface (bls), the remaining soil boring were completed to 20 feet bls. Subsurface soil samples were analyzed for pH, arsenic, mercury, selenium, cadmium, lead and EP toxicity tests for previous metals (G&M, 1985).

Four monitoring wells were installed at the soil boring locations and completed to maximum depths ranging from 142 feet to 147 feet bls. On August 10, 1985, groundwater samples were collected from the monitoring wells and analyzed for Primary Drinking Water Standard (PDWS) compounds, Secondary Drinking Water Standard (SDWS) parameters, EPA priority pollutants, and aluminum. The monitoring wells were resampled on November 1, 1985 and analyzed for EPA priority pollutants. The analytical results for the groundwater samples indicated benzene was the only compound detected at concentrations exceeding the primary drinking water standards (G&M, 1985).

The conclusions of the detection and monitoring program were that the groundwater and soils in the vicinity of the battery shop had not been adversely impacted by metals or other chemicals associated with past discharges to the dry well. However, organic compounds, particularly benzene detected at concentrations slightly above the PDWS in groundwater samples from two monitoring wells is of concern. The source of benzene in the groundwater was unknown. Trichloroethene was detected at a concentration exceeding the PDWS in a groundwater sample from the facility supply well W-S2. The recommendations were that periodic groundwater sampling be completed for a period of one year and the sampling operation be coordinated with the Navy's Installation Restoration Program (G&M, 1985).

On April 15, 1987, FDER recommended in a letter to the Navy that the Consent Order be closed.

During an April 1999 NAS Whiting Field Partnering Team meeting, discussions concerning the Site 6 RI led to the question as to whether the Detection and Monitoring Program at Site 5 had included sampling for PCB, based on the previous use of Building 1478 as the Old Transformer Repair Building. Based on a document review it was determined that analysis for PCBs had not been completed in the onsite soils and additional investigation was warranted.

3.2.1.2 Proposed Investigation

The proposed investigation activities to be performed at Site 5 are described in the following sections.

Soil Investigation Scope

- Define extent of soil contamination that exceeds applicable FDEP regulation (e.g., Florida Soil Cleanup Goals (1998), Chapter 62-785 FAC and Soil Cleanup Target Levels from Revised Chapter 62-777 FAC, if adopted).
- Define extent of soil contamination that exceeds applicable "risk benchmarks" defined by USEPA [e.g., USEPA Region VI RBCs and SSLs (USEPA 1996c)].

Source Areas of Concern

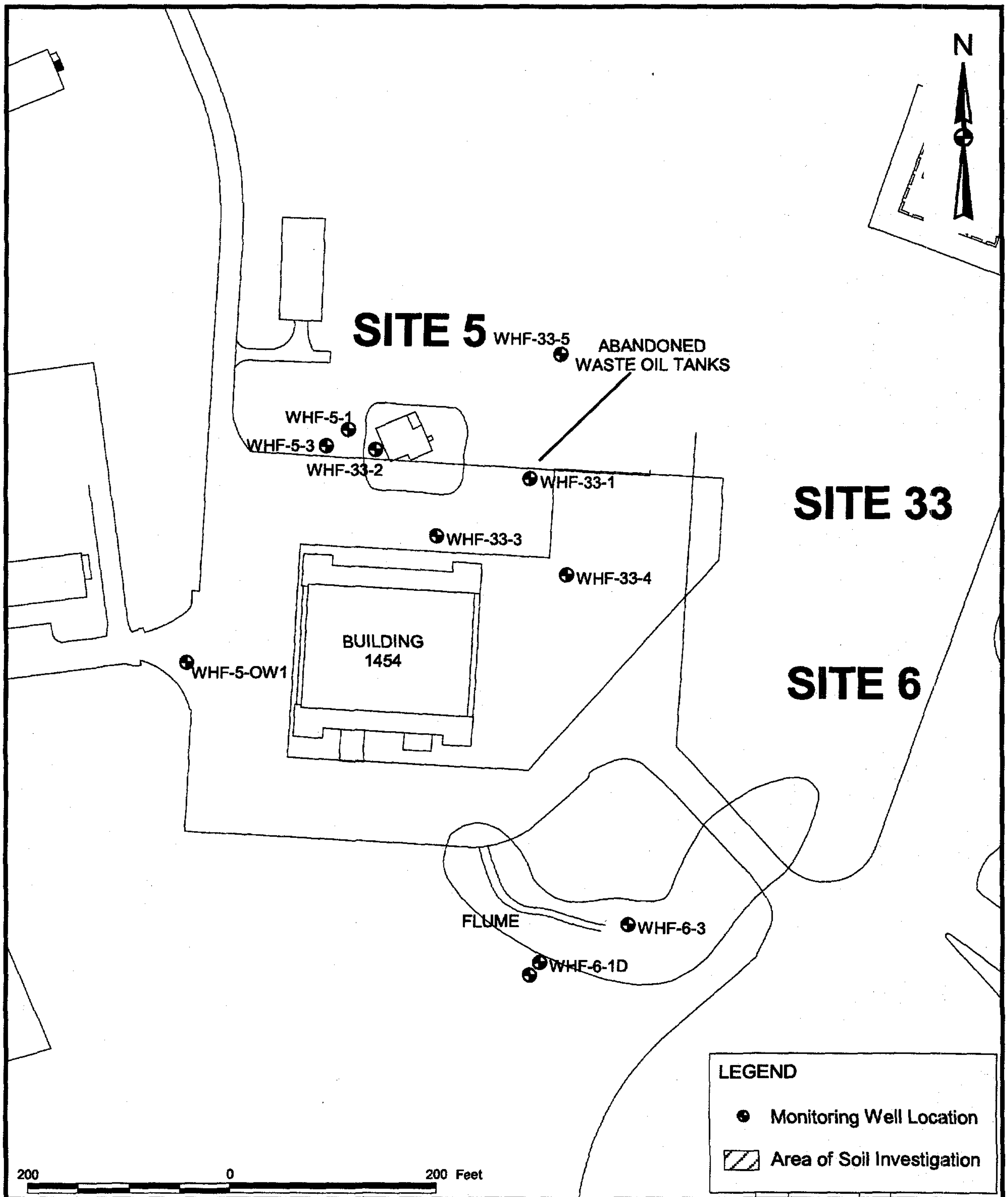
- Surface and subsurface soils surrounding the former Building 1478 location

- Subsurface soils surrounding a drain line from Building 1478 to "0-2" ditch, if present

The RI/FS investigation at Site 1478 will consist of a historic document review and interviews with Base personnel and collection of surface and subsurface soil samples. The supporting rationale for these investigation methods is presented in the box below. Figure 3-1 shows the approximate soil sampling investigation area.

RI/FS Rationale for Soil Borings at Site 5

Investigation method	Rationale
Historic document review and interviews	Determine specific site history and locate potential disposal areas and drainage lines.
Surface soil samples: 05S01, 05S02, 05S03, 05S04, and 05S05	Determine lateral extent of contamination at potential source areas of concern and determine direct exposure risk for contact with surface soils. Exact locations will be determined based on the results of the historic document review and interviews.
Soil borings 05SB01, 05SB02, 05SB03, 05SB04,05SB05, 05SB06, 05SB07, 05SB08, 05SB09, and 05SB10	Determine lateral and vertical extent of contamination at potential source areas of concern. Exact locations will be determined based on the results of the aerial photograph and geophysical surveys.



DRAWN BY J. BELLONE — DATE 12/29/99	SITE 5		CONTRACT NUMBER 0052
CHECKED BY — DATE	RI/FS WORK PLAN		APPROVED BY — DATE
COST/SCHEDULE-AREA	SITES 5, 7, 29, 35, 38, 39, 40 AND PSC 1485C		APPROVED BY — DATE
SCALE AS NOTED	NAS WHITING FIELD MILTON, FLORIDA		DRAWING NO. FIGURE 3-1 — REV 0

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Soil Sampling Criteria

Surface soil samples will be collected from the unpaved areas of the site. The samples will be recovered for a depth of 0 to 12" bls using a stainless steel spoon. The samples will be recovered following USEPA SOPs (USEPA, 1996).

All DPT soil borings will be drilled to a minimum depth of 20 feet bls. If at 20 feet bls the total OVA readings are greater than 50 ppm, then the boring will be continued likely using hollow stem auger techniques) to a depth 10 feet below the depth when OVA readings decrease to < 50 ppm or to the water table, whichever occurs first. Up to 10 subsurface soil samples will be selected for laboratory analysis based on high OVA readings, changes in lithology, or at the discretion of the site geologist based on other field observations; and the bottom of the hole. Soil samples will be analyzed for TCL Pesticides and PCBs only.

Source Areas of Concern

The source area of concern at PSC 1478 is soils surrounding the former Building 1485C location

3.2.2 Site 7: South AVGAS Tank Sludge Disposal Area

3.2.2.1 Site 7 History

The tanks at the South Fuel Farm date back to 1943 when NAS Whiting Field first began operations. The South Fuel Farm was an AVGAS Aqua Type system that used potable water to displace AVGAS and transfer fuel to tanks. The South field Fuel Farm included six underground steel tanks and two aviation lube oil tanks. Flight operations at the South Field changed from AVGAS–burning airplanes to JP-4 burning helicopters, consequently the tank farm was used solely for back up storage during the fuel shortage in 1973.

From 1943 to 1968, the nine AVGAS tanks were cleaned out approximately every 4 years. The tank bottom sludge that probably contained tetraethyl lead was buried at shallow depths in the area immediately adjacent to the surrounding tanks. Navy personnel estimated 1,000 to 2,000 gallons of sludge were disposed of in this manner (Geraghty & Miller 1986).

Twenty-eight surface soil samples were collected and mixed to produce one composite sample during the 1986 Verification Study by Geraghty & Miller. This sample was split into two parts and analyzed for total lead content and Extraction Procedure Toxicity (EP Tox) for lead. Laboratory analytical results of the soil samples showed total lead concentrations were 15 and 27 mg/kg. Lead was not detected in the EP Tox test above the method detection limit of 0.01 mg/L.

Monitoring well WHF-7-1 was installed along the southern perimeter of the USTs during the 1986 Geraghty & Miller study. This well was installed in the intermediate zone of the upper sand-and-gravel aquifer at a depth of 152 feet bls.

After the 1986 study, Site 7 was transferred from the IR program to the UST program and renamed Site 1466. During the contamination assessment of Site 1466 in 1991 and 1992, shallow monitoring wells and intermediate monitoring wells were installed. Excessively contaminated soil (organic vapor concentrations greater than 500 ppm for gasoline products) was found from the land surface and immediately above the water table during contamination assessment activities at Site 7. In a July 1992 Task Order Managers' meeting, it was determined that a decision regarding the transfer of Site 1466 from the UST program back to the IR program was needed. To support this decision, additional fieldwork was recommended to assess the site jurisdiction.. The results of the groundwater sampling are provided in the *Jurisdiction Assessment Report, Underground Storage Tank Program Sites 1466 and 1467, Installation Restoration Program Sites 7 and 4, Naval Air Station Whiting Field* (ABB-ES 1994a) and the *Remedial Investigation and Feasibility Study Technical Memorandum No. 5, Groundwater Assessment* (ABB-ES 1995c). Because solvents were detected in groundwater at Site 7, it was transferred back to the IR program.

Additional groundwater samples were taken in 1995 and 1996, and details of the analytical results are presented in the *Remedial Investigation, Industrial Area Groundwater Investigation, Interim Report, Naval Air Station Whiting Field* (ABB-ES 1996b) and *Industrial Area Groundwater Investigation, Interim Report Addendum, Naval Air Station Whiting Field* (ABB-ES 1998), respectively.

3.2.2.2 Proposed Investigation

Additional records searching and source exploration in the vicinity of Site 7 will be conducted to evaluate the status of any residual soil contamination at the former sludge disposal area and South Fuel Farm. The investigation of impacted groundwater at the South Field Industrial Area, which includes commingled BTEX and TCE plumes, will be addressed in the proposed investigation at Site 40.

The investigation activities to be performed for the soils at Site 7 are described in the following sections.

Investigation Scope

- Define extent of "excessively contaminated soils" around former USTs in accordance with FDEP regulations (i.e., total organic vapors > 50 ppm for kerosene group, > 500 ppm for gasoline group petroleum hydrocarbon release areas).

- Define extent of soil contamination that exceeds applicable FDEP regulation (e.g., Florida Soil Cleanup Goals (1998), Chapter 62785 FAC and Soil Cleanup Target Levels from Revised Chapter 62-777 FAC, if adopted).

- Define extent of soil contamination that exceeds applicable "risk benchmarks" defined by USEPA [e.g., USEPA Region VI Risk Based concentrations (RBCs) and Soil Screening Levels (SSLs; USEPA 1996d)].

Source Areas of Concern

- Former USTs and associated piping.
- Tank-bottom sludge disposal areas.

The RI/FS investigation at Site 7 will consist of four surface soil samples and 2 days of DPT soil borings with associated subsurface soil sampling to characterize the nature and extent of soil contamination. The supporting rationale for these samples is presented in the box below. Figure 3-2 shows the approximate sample locations and Table 3-3 summarizes the analysis to be completed.

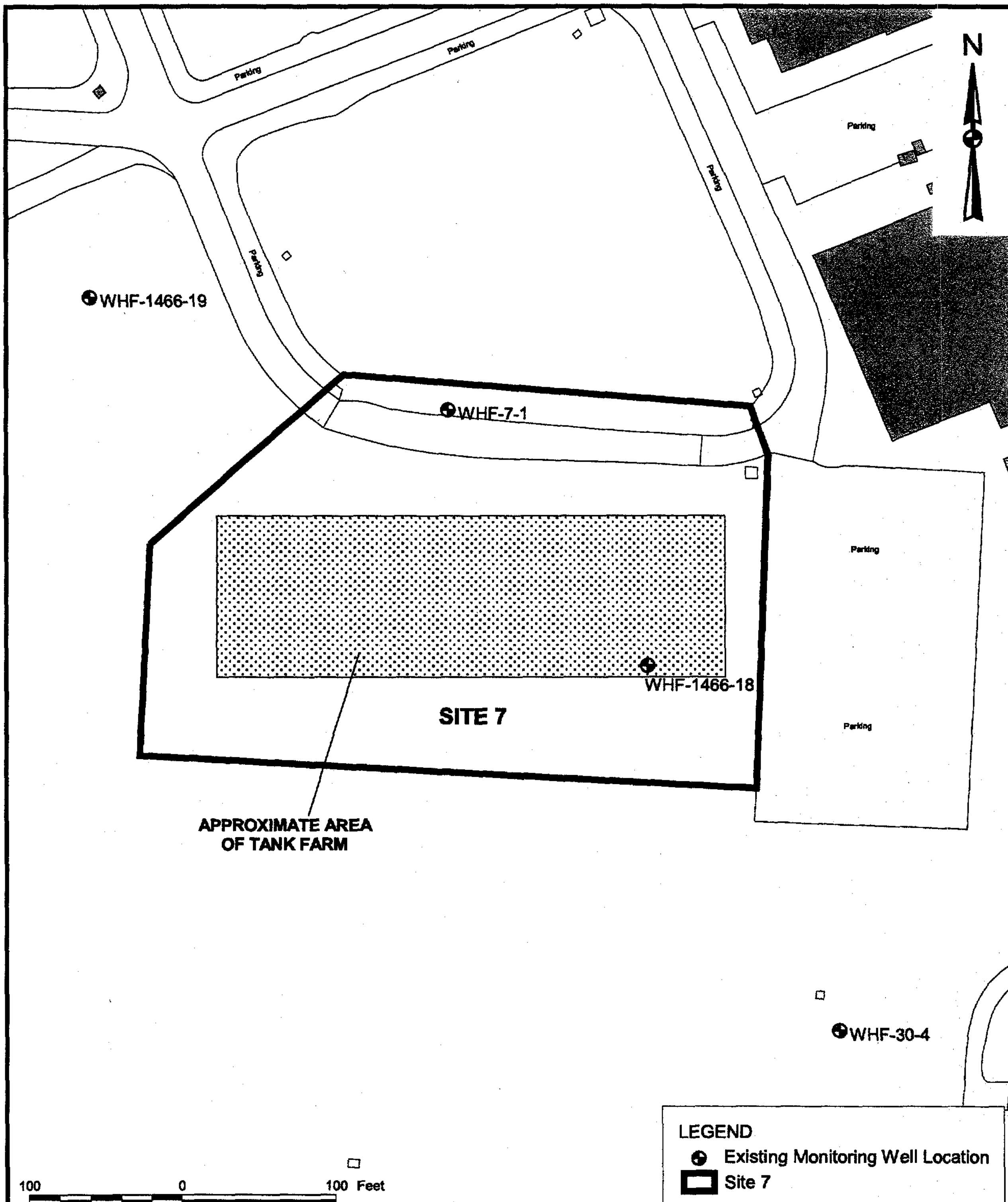

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TABLE 3-3

ANALYTICAL PROGRAM SUMMARY FOR SOIL AND SEDIMENT SAMPLES
RI/FS WORK PLAN FOR
SITES 7, 29, 36, 38, 39, 40, and PSC 1485C
NAS WHITING FIELD, MILTON, FLORIDA

Sample Identification	Estimated Quantity	CLP/TCL VOCs	CLP/TCL SVOCs	CLP/TAL Inorganics	CLP/TCL Pesticides/PCBs	Total Petroleum Hydrocarbons	SPLP or TCLP	Geotechnical/Natural Attenuation Parameters
Analysis Method		**SW8260**	**SW8270**	(b)	**SW8081**	**SW8015m**	**SW1311(c)**	(a)
SURFACE SOIL								
Site 7	4	4	4	4		4		
Site 29	6	6	6	6		6		
Site 38	12	12	12	12	12	12		
PSC 1485C	6	6	6	6	6	6		
SUBSURFACE SOIL								
Site 7	10	10	10	10		10	10	10
Site 29	10	10	10	10		10	10	10
Site 36	10	10	10	10		10	10	10
Site 38	32	32	32	32	32	32	32	32
PSC 1485C	16	16	16	16	16	16	16	16
Industrial Area Leaching[d]	49						49	49
Perimeter Road Leaching[e]	54						54	54
SEDIMENT SAMPLES								
Site 39 Creekbed	10	10	10	10	10			
Site 39 Eco Tox.	20							
Site 39 Floodplain	50	50	50	50	50			
TOTAL SAMPLES	289	166	166	166	126	106	181	181
IDW disposal sampes					50		8	
QC SAMPLES								
Duplicate	8	8	8	8	7	8		
Matrix Spike	8	8	8	8	7	8		
Matrix Spike Duplicate	8	8	8	8	7	8		
Trip Blanks[f]	15	15						
Equipment Blanks[g]	6	6	6	6	6	6		
Field Banks[h]	6	6	6	6	6	6		
TOTAL SOIL	**340**	**217**	**202**	**202**	**159**	**142**	**189**	**181**

[a] Soil geotechnical and Natural Attenuation Parameters include total organic carbon, pH, and grain size analysis.
[b] CLP/TAL Inorganics analyses by Methods SW6010, SW7471 or SW7470, SW9010, and SW9065.
[c] SPLP and TCLP analyses for inorganics, volatiles, semivolatiles, and pesticides. As indicated on Tables 3-7 and 3-8.
[d] Includes Sites 3, 4, 6, 30, 32 and 32. See Table 3-7.
[e] Includes Sites 10, 11, 13, 14, 15, 16, 17, and 18. See Table 3-8.
[f] Trip blanks will be collected at one per sample shipment.
[g] Equipment blanks will be collected at one per week during sampling operations.
[h] Field blanks will be collected at one per week during sampling operations.

Notes:

ASTM – American Society for Testing and Materials
CLP – Contract Laboratory Program
PCB – Polychlorinated biphenyls
QC – Quality control
SVOC – Semivolatile organic compound
TAL – Target analyte list
TCL – Target compound list
TCLP – Toxicity Characteristic Leaching Procedure
TPH – Total petroleum hydrocarbons
USEPA – U.S. Environmental Protection Agency
VOCs – Volatile organic compound

RI/FS Rationale for Soil Borings at Site 7	
Soil Sample Location	**Rationale**
7S01 through 7S06	Investigated surface soils to determine lateral extent of contamination at potential source areas of concern and evaluate direct contact exposure risk.
7SB01 through 7SB10	Determine vertical & lateral extent of contamination around former USTs.

Soil Sampling Criteria

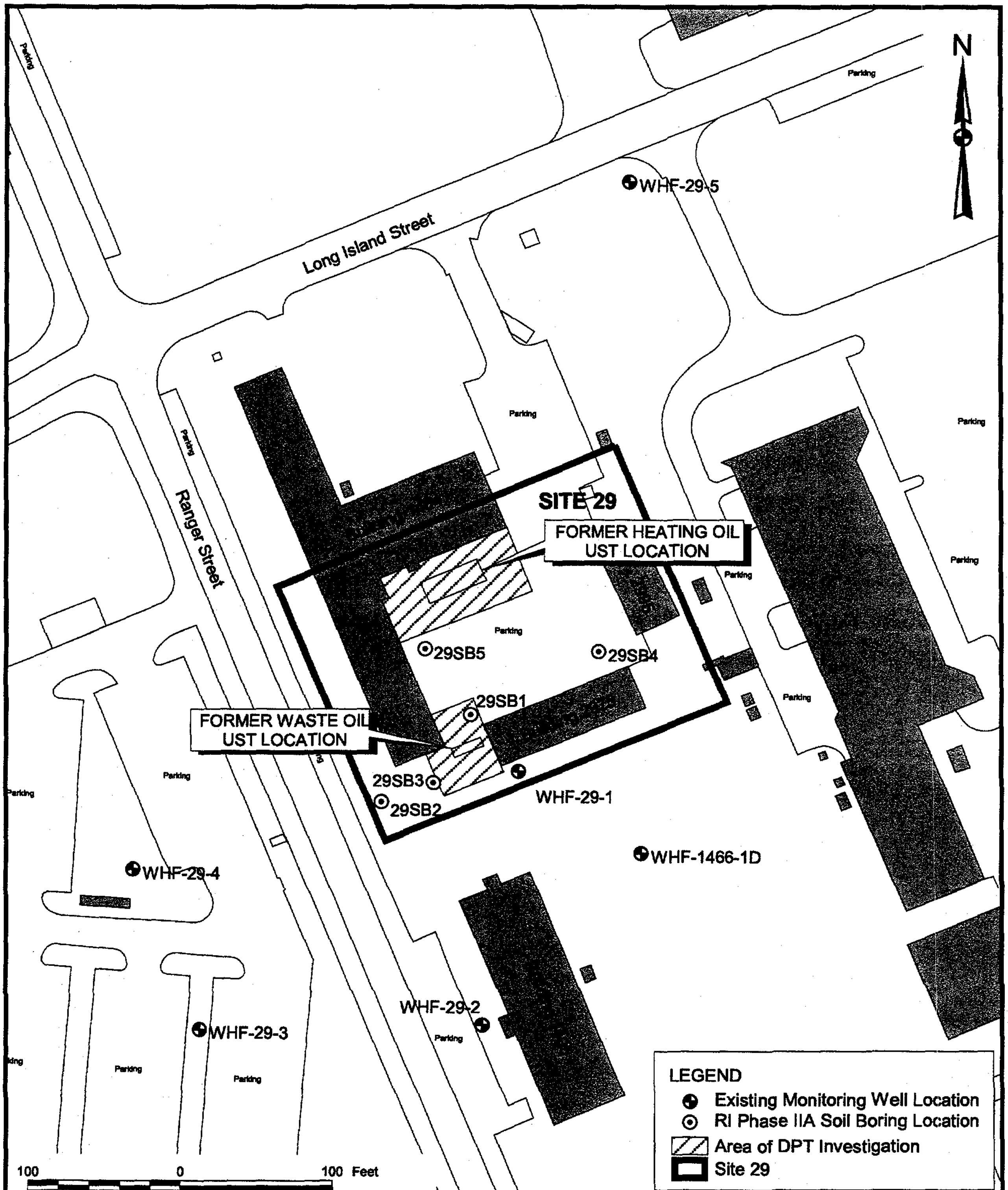
Surface soil samples will be collected from the unpaved areas of the site. The samples will be recovered for a depth of 0 to 12" bls using a stainless steel spoon. The samples will be recovered following USEPA SOPs (USEPA, 1996).

All DPT soil borings will be drilled to a minimum depth of 30 feet bls. If at 30 feet bls the total OVA readings are greater than 50 ppm, then the boring will be continued (likely using hollow stem auger techniques) to a depth 10 feet below the depth when OVA readings decrease to < 50 ppm or to the water table, whichever occurs first. Up to 10 subsurface soil samples will be selected for laboratory analysis based on high OVA readings, changes in lithology, or at the discretion of the site geologist based on other field observations; and the bottom of the hole. Soil samples will be analyzed for TCL VOCs, TCL SVOCs, TAL inorganics, and Total Petroleum Hydrocarbons (TPH), and SPLP analysis.

3.2.3 Site 29: Auto Hobby Shop

3.2.3.1 Site 29 Location and Description

Site 29 is located in the area surrounding Buildings 1404 and 2975 (Figure 3-3). One underground metal storage tank was installed in the 1940's for storage of waste motor oil generated from vehicle maintenance operations conducted at the Auto Hobby Shop. The tank was located southeast of Building 1404 and west of Building 2975 (see Figure 3-3). The tank was initially abandoned in place in 1986 and was removed from the site in 1998. Another underground storage used for heating oil was located in the



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parking area between Buildings 1404 and 2975. The location of the heating oil tank is shown in Figure 3-3. This tank was used for storage of heating oil specifically for Building 1404 and was presumably installed in the mid 1940's. The tank was removed in 1998.

3.2.3.2 Site 29 History

Building 1440 has been used since the 1940's for base personnel vehicle repairs and wood working and hobby activities. Building 2975 is used for vehicle and supply storage. The waste oil tank was used for disposal of waste motor oil and potentially solvents and paints from the 1940's until 1986. In 1986, the tank was abandoned in place by filling with sand. This apparently occurred before the tank was included in the formal tank management program at the Facility. It is unknown if the tank was pumped of materials as part of the abandonment. Following abandonment an above ground waste oil tank was placed at the location for continued disposal activities. The heating oil tank is believed to have been used for heating oil only and no other materials were placed in the tank.

Site 29 was added to the RI/FS investigation at NAS Whiting Field between 1992 and 1993 based on the presence of the waste oil UST which is similar to Underground Storage Tanks present at the North Field, Mid Field, and South Field Hangars. The site was not investigated during the Initial Assessment Study, Verification Study, or Phase I of the RI/FS at the Facility.

Investigations conducted during Phase IIA and IIB of the RI/FS included a passive soil gas investigation, subsurface soil sampling, and groundwater sampling. The results of the passive soil gas investigation and subsurface soil sampling are summarized in Appendix C and Chapter 4, respectively, of the Phase IIA Technical Memorandum No. 3 Soils Assessment (ABB-ES, 1995d). The groundwater analytical results are summarized in RI/FS Phase IIA, Technical Memorandum No. 5 Groundwater Assessment (ABB-ES, 1995b).

In June 1998, Bechtel Environmental Inc. removed the waste oil tank from the site as part of the Interim Removal Action at the site. The abandoned UST was removed by manually excavating approximately 2 ft of soil overlying the tank and hand excavating soil around the tank to mechanically lift the tank. Before removal, the UST was opened and reported to be approximately half full of sand with trace amounts of water. Once the tank was removed only a small amount of standing water was present and very little staining of the outside soil was observed. The standing water was removed and the stained soil was excavated (Conrad, 1998).

Following the UST removal, confirmation soil samples were collected for offsite laboratory analysis. A soil sample was collected from each of the four excavation sidewalls at approximately 4 ft bls and from the bottom of the excavation at approximately 7 ft bls. In addition, a single soil sample was collected from the area where an abandoned heating oil tank had previously been removed. This sample was collected from a depth of 10 ft bls. All of the soil samples were analyzed for Priority Pollutant VOCs, SVOCs, TRPHs, arsenic, barium, cadmium, lead, selenium, silver, and mercury (Conrad, 1998).

The analytical results for the soil samples indicated three samples contained analyte concentrations exceeding Florida regulatory limits. The soil sample from the north sidewall sample contained: benzene (0.28 mg/kg), ethylbenzene (1.00 mg/kg), toluene (0.86 mg/kg), xylenes (4.40 mg/kg), and naphthalene (2.60 mg/kg) at concentrations exceeding Florida Soil Cleanup Target Levels (F.A.C. Chapter 62-777). The soil sample from the east side-wall sample contained: benzene (0.16 mg/kg), toluene (0.62 mg/kg), xylenes (2.6 mg/kg), and naphthalene (2.50 mg/kg) at concentrations exceeding Florida Soil Cleanup Target Levels (F.A.C. Chapter 62-777). All of the soil samples collected from the waste oil UST contained concentrations of TRPH exceeding regulatory limits. All of the samples from the excavation contained concentrations of chromium exceeding the TCLP regulatory limit and four of the five samples (excluding the south wall sample) contained lead at concentrations exceeding the TCLP criteria (Conrad, 1998).

The soil sample from the abandoned heating-oil tank contained concentrations of benzene and toluene at concentrations exceeding Florida Soil Cleanup Target Levels (F.A.C. Chapter 62-777) and detected concentrations of chromium and lead exceeded the TCLP regulatory limits (Conrad, 1998). The Interim Removal Action was summarized in a letter from the Remedial Action Contractor to the Santa Rosa County Petroleum Program in August 24, 1998. A copy of the letter is included in Appendix G to this Work Plan.

3.2.3.3 Proposed Investigation

Additional source delineation will be conducted in the vicinity of the former waste oil and heating oil tanks to determine the extent of soil contamination. The investigation of groundwater at the site, will be addressed in the facility-wide groundwater investigation discussed in Section 3.2.6. The investigation activities proposed for soils at Site 29 are described below.

Investigation Scope

- Define extent of "excessively contaminated soils" around former USTs in accordance with FDEP regulations [i.e., *total organic vapors* > 50 parts per million (ppm) for kerosene group, > 500 ppm for gasoline group petroleum hydrocarbon release areas].

- Define extent of soil contamination that exceeds applicable FDEP regulation [e.g., Florida Soil Cleanup Goals (1998), Chapter 62-785 FAC and Soil Cleanup Target Levels from Revised Chapter 62-777 FAC, if adopted].

- Define extent of soil contamination that exceeds applicable "risk benchmarks" defined by USEPA [e.g., USEPA Region VI RBCs and SSLs (USEPA 1996c)].

Source Areas of Concern

- Former waste oil UST location between Building 2975 and Building 1404.
- Former heating oil UST location in the parking area east of Building 1404.

The RI/FS investigation at Site 29 will consist of six surface soil samples and 2 days of DPT soil borings with associated subsurface soil sampling to characterize the nature and extent of soil contamination. The supporting rationale for these samples is presented in the box below. Figure 3-3 shows the investigation area and Table 3-3 summarizes the analysis to be completed.

RI/FS Rationale for Soil Borings at Site 29	
Soil Sample Location	**Rationale**
29S01 through 29S06	Investigated surface soils to determine lateral extent of contamination at potential source areas of concern and evaluate direct contact exposure risk.
29SB01 through 29SB10	Determine vertical & lateral extent of contamination around former USTs.

Soil Sampling Criteria

Surface soil samples will be collected from the unpaved areas of the site. The samples will be recovered for a depth of 0 to 12” bls using a stainless steel spoon. The samples will be recovered following USEPA SOPs (USEPA, 1996b).

All DPT soil borings will be drilled to a minimum depth of 30 feet bls. If at 30 feet bls the total OVA readings are greater than 50 ppm, then the boring will be continued to a depth 10 feet below the depth when OVA readings decrease to < 50 ppm or to the water table, whichever occurs first. Up to 10 subsurface soil samples will be selected for laboratory analysis based on high OVA readings, changes in lithology, or at the discretion of the site geologist based on other field observations; and the bottom of the hole. Soil samples will be analyzed for TCL VOCs, SVOCs, TAL inorganics, TPH, and SPLP analysis.

3.2.4 Site 35: Building 1429A, Auto Repair Booth

3.2.4.1 Site 35 Location and History

Building 1429, Public works Maintenance Facility Repair Booth is located on Saratoga Street in the approximate center of the facility's industrial area. The building was built in 1943 and used for the maintenance of vehicles and equipment, generation of power and heat, storage of fire fighting equipment, woodworking and metals repair, and offices. A gasoline service station (formerly Building 2848) with a pump island and underground fuel tanks was located at the northwest side of the building. The service station was equipped with three underground storage tanks (one diesel- tank no. 2851, and two gasoline – tank no. 1429 I and 1429 J) located west of the pump island and under the vehicle shed. All three tanks were abandoned in place in 1984. The tanks were abandoned by pumping out the remaining fuel, filling with sand and capping the fill ports with concrete. None of the tanks have been removed since abandonment.

Four 25,000-gallon fuel oil tanks and one 10,000-gallon diesel underground storage tanks are also located at Building 1429. The fuel oil tanks were used for facility wide heat generation and the diesel tanks is connected to emergency generators in Building 1429. Currently fuel oil is delivered to the tanks via tanker trucks, however, previously deliveries were made by railroad tank cars. The railroad spur is still present at the site and a catch basin for spillage was observed during a site walkover. The discharge point for the catch basin is unknown. Possible wastes associated with Building 1429 include fuel, oil and solvents.

Based on a record search and interviews with facility personnel, Building 1429 was identified as a potential site in July, 1993. The site was added to the IR program in 1995 and a Site Screening Investigation (SSI) was initiated in December, 1996. The purpose of the SSI was to complete an initial screening assessment to determine if contaminants are present and if additional investigations are warranted.

The SSI included the completion of soil borings, subsurface soil sampling, monitoring well installation, and groundwater sampling. Four soil borings were completed to a depth of 30 ft bls at Site 35. One additional soil boring (35B001) was completed to depth of 54 feet bls. The deeper soil boring was located to investigate the fuel pump island and UST area. All of the soil borings were continuously split spoon sample to the total depth of the boring. The split spoon samples were screened in the field for dense nonaqueous phase liquids using an ultraviolet light and centrifuge red dye test, total OVA headspace measurements, and field gas chromatograph (GC) screening. The field GC analysis was conducted using a HNUTM 311 portable GC. The soil samples were analyzed for VOCs BTEX, dichloroethene, perchloroethene (PCE), and TCE. In addition confirmation soil samples were also collected for laboratory analysis. Three subsurface soil samples from each soil boring were analyzed for TCL VOCs.

Six monitoring wells were installed at the site at two nested well location. Following the installation and development of the monitoring wells, a groundwater sample was collected from each well and analyzed for TCL VOCs, SVOCs, Pesticides and PCBs, and TAL inorganics.

The analytical results for the SSI are summarized in the draft final Report on Sites 35, 36, and 37, NAS Whiting Field, Milton, Florida completed on February 3, 1999. The summary and recommendations of the report indicated no VOCs were detected at concentrations exceeding regulatory criteria in the subsurface soil samples collected from Sites 36 and 37. However, the analytical results for soil boring 35B001 (associated with the Site 36 fuel pump island) indicated contaminated soil at levels exceeding the soil gas headspace criteria of 50 ppm for excessively contaminated soils as defined by the State of Florida (Chapter 62-770, FAC). Laboratory analysis of the subsurface soil samples also indicated VOC concentrations typically associated with petroleum contamination exceeding the Florida Soil Cleanup Target Levels for leaching soils. [Harding Lawson Associates (HLA), 1999]. In addition, the shallow and deep groundwater samples collected from Site 36 contained TCE at concentrations exceeding Florida and Federal regulatory limits.

The recommendations of the HLA report were that additional soil sampling be conducted at former gas pumps and underground storage tank area and additional groundwater sampling be conducted at Site 36 to assess the extent of chlorinated solvent groundwater contamination (HLA, 1999).

3.2.4.2 Proposed Investigation

Additional source delineation will be conducted in the vicinity of the former fuel island and UST area to determine the extent of soil contamination. The investigation of groundwater at the site, will be addressed in the facility-wide groundwater investigation discussed in Section 3.2.6. The investigation activities proposed for soils at Site 35 are described below.

Investigation Scope

- Define extent of "excessively contaminated soils" around former fuel island and USTs in accordance with FDEP regulations [i.e., total organic vapors > 50 parts per million (ppm) for kerosene group, > 500 ppm for gasoline group petroleum hydrocarbon release areas].

- Define extent of subsurface soil contamination that exceeds applicable FDEP regulation (e.g., Florida Soil Cleanup Goals (1995), Chapter 62770 FAC and Soil Cleanup Target Levels from Revised Chapter 62-770 FAC, if adopted).

- Define extent of subsurface soil contamination that exceeds applicable "risk benchmarks" defined by USEPA [e.g., USEPA Region VI RBCs and SSLs (USEPA 1996d)].

Source Areas of Concern

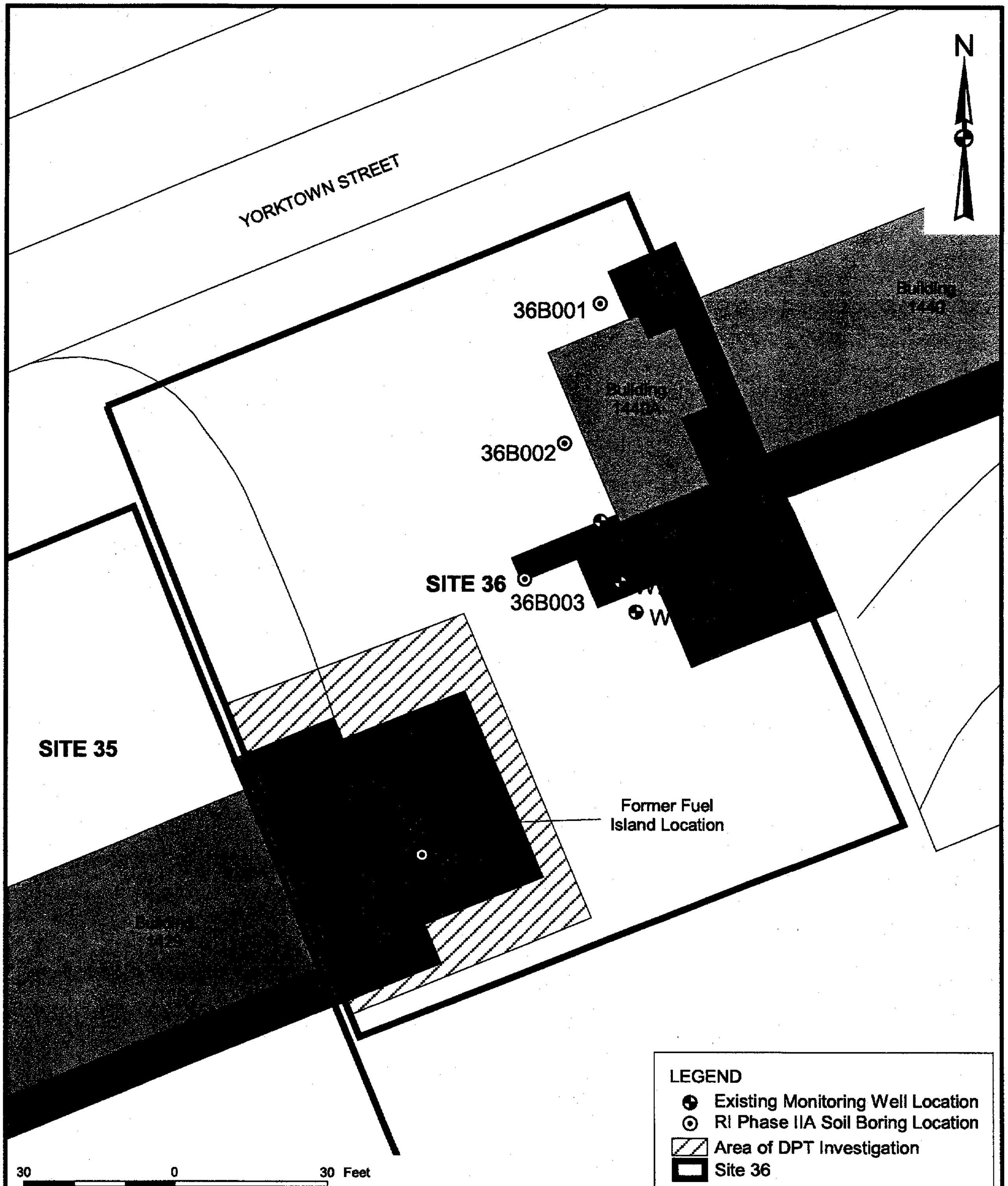
- Former fuel island location east of Building 1429

The RI/FS investigation at Site 35 will consist of 2 days of DPT soil borings and associated subsurface soil sampling to characterize the nature and extent of soil contamination. The supporting rationale for these samples is presented in the box below. Figure 3-4 shows the investigation area and Table 3-3 summarizes the analysis to be completed.

Soil Sampling Criteria

All DPT soil borings will be drilled to a minimum depth of 30 feet bls. If at 30 feet bls the total OVA readings are greater than 50 ppm, then the boring will be continued (likely using hollow stem auger soil boring technique) to a depth 10 feet below the depth when OVA readings decrease to < 50 ppm or to the water table, whichever occurs first. Up to 10 subsurface soil samples will be selected for laboratory analysis based on high OVA readings, changes in lithology, or at the discretion of the site geologist based on other field observations; and the bottom of the hole. Soil samples will be analyzed for TCL VOCs, TAL inorganics, and TCLP analysis.

RI/FS Rationale for Soil Borings at Site 35	
Soil Sample Location	**Rationale**
35SB01 through 35SB10	Determine vertical & lateral extent of contamination around former USTs.



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RI/FS WORK PLAN
SITES 5, 7, 29, 35, 38, 39, 40 AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA

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3.2.5 Site 38: Building 2877, Former Golf Course Maintenance Building

3.2.5.1 Site 38 Location and Description

Site 38 is located immediately west of the 7th hole fairway on the NAS Whiting Field Golf Course. The site includes the former Building 2877 which was located approximately 276 feet west of the patrol road and 860 feet north of the white lattice fence associated with the pistol firing range.

3.2.5.2 Site 38 History

Building 2877 was used as the golf course maintenance building. Review of historical aerial photographs indicate the building was present in June, 1954 during the construction of NAS Whiting Field Golf Course. Reportedly, battery reconditioning was conducted at this building. The battery acid from golf cart batteries was drained into a sink inside the building. The sink drained into a tank that consisted of an underground concrete culvert open at one end. The tank retained approximately 50 gallons of liquid before draining to the subsurface. The tank was filled with rock sometime between 1974 and 1979. The battery acid draining was discontinued at this time.

Pesticides including organophosphates, herbicides, fungicides, chlordane, heptachlor epoxide, and some hydrocarbon pesticides were also stored and handled in Building 2877 during operations. Pesticide storage was discontinued in 1983 when a new pesticide facility was completed. A one-acre area north of the building and across the access road, was used to rinse trucks after they were used to spray pesticides. A 200 foot by 200 foot area located southwest of the building was used to fill pesticide containers. Possible wastes associated with the site include battery acid, fuels, solvents and pesticides.

Building 2877 was demolished in 1993 as part of an upgrading and reconstruction project for the NAS Whiting Field Golf Course. The concrete building foundation is believed to still be present, however it is unknown if the former drainage tank is still present.

In March 1996, Brown & Root Environmental Services, Inc. collected a single surface soil sample (0 to 1 foot sample depth) at the site. The sample was collected to support the Navy's relative risk ranking for the site. The soil sample was analyzed for TCL VOCs, SVOCs, pesticides and PCBs and TAL inorganics. No organic compounds were detected above analytical method detection limits.

3.2.5.3 Proposed Investigation

The investigation activities proposed for Site 38 are described in the following sections.

Soil Investigation Scope

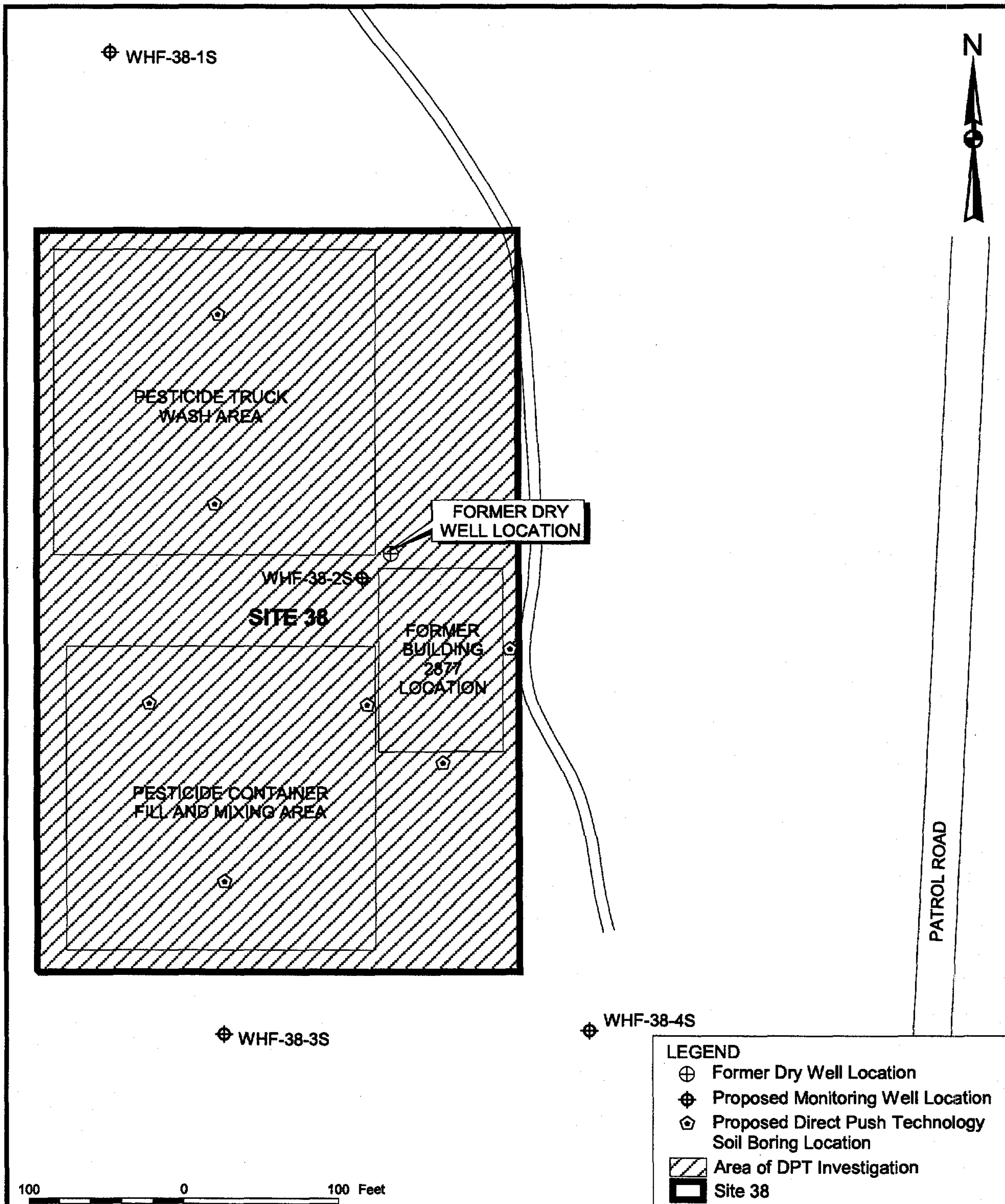
- Define extent of subsurface soil contamination that exceeds applicable FDEP regulation (e.g., Florida Soil Cleanup Goals (1998), Chapter 62-785 FAC and Soil Cleanup Target Levels from Revised Chapter 62-777 FAC, if adopted).

- Define extent of subsurface soil contamination that exceeds applicable "risk benchmarks" defined by USEPA [e.g., USEPA Region VI RBCs and SSLs (USEPA 1996c)].

Source Areas of Concern

- Former battery acid disposal tank
- Former pesticide truck wash area
- Former pesticide container fill area
- Flooring of Building 2877

The RI/FS investigation at Site 38 will consist of a historic aerial photo review, a geophysical survey, collection of surface and subsurface soil samples and the installation and sampling of monitoring wells. The supporting rationale for these investigation methods is presented in the box below. Figure 3-5 shows approximate locations of the soil borings and Table 3-3 summarizes the laboratory analysis to be completed.



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RI/FS Rationale for Soil Borings at Site 38	
Investigation method	**Rationale**
Aerial photograph review	Determine specific site history and located potential disposal areas.
Geophysical survey	Use electromagnetic, magnetometer instruments to determine building foundation and battery acid disposal tank.
Surface soil samples: 38S01, 38S02, 38S03, 38S04, 38S05, 38S06, 38S07, 38S08, 38S09, 38S10, 38S11, and 38S12	Determine lateral extent of contamination at potential source areas of concern and determine direct exposure risk for contact with surface soils. Exact locations will be determined based on the results of the Aerial photograph and geophysical surveys.
Soil borings 38SB01, 38SB02, 38SB03, 38SB04, 38SB05, 38SB06, 38SB07, and 38SB08	Determine lateral and vertical extent of contamination at potential source areas of concern. Exact locations will be determined based on the results of the aerial photograph and geophysical surveys.

Soil Investigation Criteria

Initially, a surface geophysical survey electromagnetic and magnetometer instruments will be completed over the site investigation area to identify buried features including the former building location and battery acid seepage pit. To complete the survey, a formal grid will not be established and surveyed, instead a general walkover of the site area will be completed. Areas identified during the initial geophysical walkover will be marked and recorded and additional reconnaissance of the specific anomaly areas will be completed. Location coordinates of any identified geophysical anomalies will be determined using a GPS instrument.

Surface soil samples will be collected from the unpaved areas of the site. The samples will be recovered from a depth of 0 to 12" bls using a stainless steel spoon. The samples will be recovered following USEPA SOPs (USEPA, 1996b).

All DPT soil borings will be drilled to a minimum depth of 30 feet bls. If at 30 feet bls the total OVA readings are greater than 50 ppm, then the boring will be continued likely using hollow stem auger techniques) to a depth 10 feet below the depth when OVA readings decrease to < 50 ppm or to the water table, whichever occurs first. Up to 10 subsurface soil samples will be selected for laboratory analysis based on high OVA readings, changes in lithology, or at the discretion of the site geologist based on other field observations; and the bottom of the hole. Soil samples will be analyzed for TCL VOCs, SVOCs, Pesticides and PCBs, TAL inorganics, TPH, and SPLP analysis.

Groundwater Investigation Scope

Although groundwater for each of the facility sites is being addressed under Site 40, Facility-wide Groundwater Investigation, the proposed groundwater investigation for Site 38 is presented here and will be incorporated into the Site 40 RI/FS. The investigation activities proposed for groundwater at Site 38 are described below.

- Identify and characterize extent (if present) of groundwater contamination that exceeds regulatory criteria (e.g., USEPA and Florida MCLs at Site 38.
- Collect supporting data to evaluate risk and natural attenuation of groundwater plume.

Source Areas of Concern

The source areas of concern at Sites 38 are listed below.

- Former battery acid disposal tank
- Former pesticide truck wash area
- Former pesticide container fill area
- Flooring of Building 2877

Proposed Investigation

The RI/FS investigation at Site 38 will include four additional installation and sampling of monitoring wells to characterize the nature and extent of groundwater contamination. The supporting rationale for these monitoring wells is presented below. Figure 3-5 shows the approximate locations of the proposed monitoring wells.

RI/FS Rationale for Monitoring Wells at Site 38

Monitoring Well Location	Rationale
WHF-38-1S	Determine background concentrations in the shallow groundwater immediately upgradient of the site.
WHF-38-2S, WHF-38-3S, and WHF-38-4S	Investigate downgradient extent of groundwater contamination in shallow groundwater.

Groundwater Sampling Criteria

Groundwater from all new wells will be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, TAL inorganics, and natural attenuation parameters. Analyses to be performed on groundwater samples are shown on Table 3-4. Natural attenuation and water quality parameters will be limited to the field analysis shown below.

Groundwater Natural Attenuation and Water Quality Parameter Analyses		
Parameter	**Test Method**	**Test Location**
Dissolved Oxygen (DO)	DO Meter (DO >0.5 mg/L) Field Titration Kit (DO <0.5 mg/L)	Field
Iron II (Fe^{+2})	Hach Method 8146	Field
Oxidation-Reduction Potential (Redox)	Redox Meter	Field
pH	pH Meter	Field
Temperature	Meter	Field
Specific Conductance	Meter	Field
Alkalinity	Hach Kit AL, AP, MG-L	Field

3.2.6 Potential Source of Concern 1485C

3.2.6.1 PSC 1485C Pesticide Storage Building 1485C Location and Description

PSC 1485C, the Pesticide Storage Building 1485C, is located at the former site of Building 1485C. The building was located within the Base Operating Services (BOS) Compound west of the northern termination of Yorktown Street and was used for storage of ground maintenance equipment and limited amounts of pesticide compounds.

3.2.6.2 Site 1485C History

The Pesticide Storage Building 1485C caught fire in the late 1980's and was completely destroyed. Following the fire, cleanup activities at the site included the removal of all building materials and the building foundation and slab flooring. The depth of the removal excavation and disposal history of the removed materials is unknown. No previous investigations have been completed at the site.

TABLE 3-4

ANALYTICAL PROGRAM SUMMARY FOR GROUNDWATER AND SURFACE WATER SAMPLES
RI/FS WORK PLAN FOR
SITES 29, 36, 38, 39, 40, and PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA

Sample Identification	Estimated Quantity	CLP/TCL VOCs	CLP/TCL SVOCs	CLP/TAL Inorganics	CLP/TCL Pesticides/PCBs	TPH	Total Organic Carbon	Geotechnical/Natural Attenuation Parameters
Analysis Method		SW8260	SW8270	(a)	SW8081	SW8015m		(b
GROUNDWATER								
Site Specific Background Wells	4	4	4	4	4	0		
Perimeter Road Sites[c]	17	1	2	17				
Site 38	4	4	4	4	4	4		4
PSC 1485C	1	1	1	1	1	1		1
UST Site 1438/1439	1	1	1	1		1		1
Existing Wells N. Field	12	12						12
Existing Wells S. Field	12	12						12
North Field Perched Zone MWs	6	6	6	6	6	6		6
Existing Site 40 Point of Complience wells	18	18						18
Site 40 New MWs	24	24	24	24	24			24
Site 39 Creek Bed[(d)]	26	26						
Site 39 Flood Plain[(d)]	50	50						
SURFACE WATER								
Site 39 Creek Bed	26	26	13	13	13		13	
Site 39 Flood Plain	50	50	50	50	50		50	
TOTAL SAMPLES	**251**	**235**	**105**	**120**	**102**	**12**	**63**	**78**
IDW samples	8	8	8	8	8			
QC SAMPLES								
Duplicate[e]	12	12	5	6	5	6	6	
Matrix Spike[e]	12	12	5	6	5			
Matrix Spike Dup[e]	12	12	5	6	5			
Trip Blanks[f]	50	50						
Equipment Blank[g]	22	22	22	22	22			
Field Blank[h]	22	22	22	22	22			
TOTAL SAMPLES	**389**	**373**	**172**	**190**	**169**	**30**	**69**	**78**

TABLE 3-4 continued

**ANALYTICAL PROGRAM SUMMARY FOR PERIMETER ROAD GROUNDWATER SAMPLES
RI/FS WORK PLAN FOR
SITES 29, 36, 38, 39, 40, and PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA**

Sample Identification	Estimated Quantity	Aluminum	Arsenic	Iron	manganese	CLP/TCL VOCs	CLP/TCL SVOCs	Monitoring wells to be sampled
Analysis Method		**SW6010**	**SW6010**	**SW6010**	**SW6010**	**SW8260**	**SW8270**	(a)
Site 1	2	2		1				1-2S & 1-3S
Site 2	1	1						2-1S
Site 9	2	2	2					9-2S & 9-3S
Site 11	5	3	3	4	3	1	2	11-1S, 11-2S, 11-3S, 11-4S, & 11-4D
Site 13	6	1		3	6			13-1S, 13-1I, 13-1D, 13-2S, 13-3S, & 13-4S
Site 14	1		1					14-1S
TOTAL SAMPLES	**17**	**9**	**6**	**8**	**9**	**1**	**2**	

(A) CLP/TAL Inorganics analyses by Methods SW6010, SW7471 or SW7470, SW9010, and SW9065.
(B) Soil Geotechnical and Natural Attenuation Parameters and analytical methods are listed in Section 3.2.1.3. Groundwater Natural Attenuation Parameters are listed in Section 3.2.3.3.
(c) Includes Perimeter Road sites 1, 2, 9, 11, 13, and 14. Specific analysis indicated on Table 3-5.
(d) Groundwater to surface water interface sample.
(e) Duplicate, Matrix Spike & Matrix spike duplicate samples will be collected at a ratio of 5 % of total samples.
(f) Trip blanks will be collected at one per sample cooler shipment.
(g) Equipment blanks will be collected one per week.
(h) Field blanks will be collected at one per week.

Notes:

ASTM – American Society for Testing and Materials
CLP – Contract Laboratory Program
PCB – Polychlorinated biphenyls
QC – Quality control
SVOC – Semivolatile organic compound
TAL – Target analyte list
TCL – Target compound list
TCLP – Toxicity Characteristic Leaching Procedure
TPH – Total petroleum hydrocarbons
USEPA – U.S. Environmental Protection Agency
VOCs – Volatile organic compound

3.2.6.3 Proposed Investigation

The proposed investigation activities to be performed at Site 1485C are described in the following sections.

Soil Investigation Scope

- Define extent of soil contamination that exceeds applicable FDEP regulation (e.g., Florida Soil Cleanup Goals (1998), Chapter 62-785 FAC and Soil Cleanup Target Levels from Revised Chapter 62-777 FAC, if adopted).

- Define extent of soil contamination that exceeds applicable "risk benchmarks" defined by USEPA [e.g., USEPA Region VI RBCs and SSLs (USEPA 1996c)].

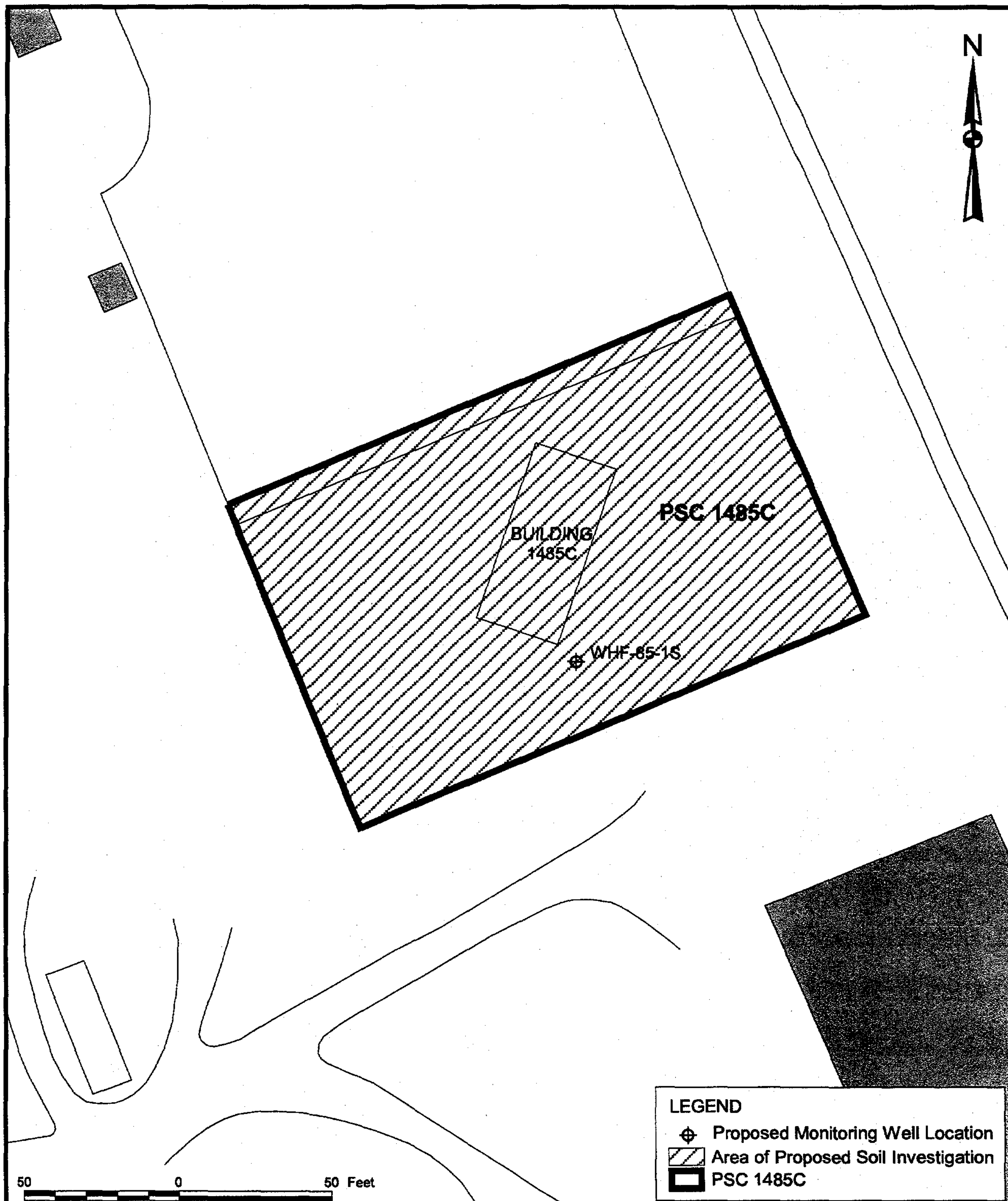
Source Areas of Concern

- Surface and subsurface soils surrounding the former Building 1485C location

The RI/FS investigation at Site 1485C will consist of a historic document review and interviews with Base personnel, collection of surface and subsurface soil samples, and the installation and sampling of a monitoring well. The supporting rationale for these investigation methods is presented in the box below. Figure 3-6 shows the approximate soil sampling investigation area.

RI/FS Rationale for Soil Borings at Site 1485C

Investigation method	Rationale
Historic document review and interviews	Determine specific site history and located potential disposal areas.
Surface soil samples: 85S01, 85S02, 85S03, 85S04, 85S05, and 85S06	Determine lateral extent of contamination at potential source areas of concern and determine direct exposure risk for contact with surface soils. Exact locations will be determined based on the results of the historic document review and interviews.
Soil borings 85SB01, 85SB02, 85SB03, and 85SB04	Determine lateral and vertical extent of contamination at potential source areas of concern. Exact locations will be determined based on the results of the aerial photograph and geophysical surveys.



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CHECKED BY — DATE			APPROVED BY — DATE
COST/SCHEDULE-AREA			APPROVED BY — DATE
SCALE AS NOTED			DRAWING NO. FIGURE 3-6 — REV 0

P:\GIS\NAS_WHITING_FIELD\RI_FS_WORK_PLAN.APR\SITE 1485C LAYOUT JCB 12/29/99

Soil Sampling Criteria

Surface soil samples will be collected from the unpaved areas of the site. The samples will be recovered for a depth of 0 to 12" bls using a stainless steel spoon. The samples will be recovered following USEPA SOPs (USEPA, 1996).

All DPT soil borings will be drilled to a minimum depth of 30 feet bls. If at 30 feet bls the total OVA readings are greater than 50 ppm, then the boring will be continued likely using hollow stem auger techniques) to a depth 10 feet below the depth when OVA readings decrease to < 50 ppm or to the water table, whichever occurs first. Up to 10 subsurface soil samples will be selected for laboratory analysis based on high OVA readings, changes in lithology, or at the discretion of the site geologist based on other field observations; and the bottom of the hole. Soil samples will be analyzed for TCL VOCs, SVOCs, Pesticides and PCBs, TAL inorganics, TPH, and SPLP analysis.

Groundwater Investigation Scope

Although groundwater for each of the facility sites in being addressed under Site 40, Facility-wide Groundwater Investigation, the proposed groundwater investigation for Site 38 is presented here and will be incorporated into the Site 40 RI/FS. The investigation activities proposed for groundwater at PSC 1485C are described below.

- Identify and characterize extent (if present) of groundwater contamination that exceeds regulatory criteria (e.g., USEPA and Florida MCLs) at PSC 1485C.

- Collect supporting data to evaluate risk and natural attenuation of groundwater plume.

Source Areas of Concern

The source area of concern at PSC 1485C is listed below.

- Soils surrounding the former Building 1485C location

Proposed Investigation

The RI/FS investigation at Site 1485C will include one additional monitoring well to characterize the nature and extent of groundwater contamination. The supporting rationale for this monitoring well is presented below. Figure 3-6 shows the approximate location of the proposed monitoring well.

RI/FS Rationale for Monitoring Wells at Site 1485C	
Monitoring Well Location	**Rationale**
WHF-85-1S	Investigate downgradient extent of groundwater contamination in shallow groundwater.

Groundwater Sampling Criteria

Groundwater from the new monitoring well will be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, TAL inorganics, and natural attenuation parameters. The analyses to be performed on groundwater samples are shown on Table 3-4. Natural attenuation and water quality parameters will be limited to the field analysis shown below.

Groundwater Natural Attenuation and Water Quality Parameter Analyses		
Parameter	**Test Method**	**Test Location**
Dissolved Oxygen (DO)	DO Meter (DO >0.5 mg/L) Field Titration Kit (DO <0.5 mg/L)	Field
Iron II (Fe^{+2})	Hach Method 8146	Field
Oxidation-Reduction Potential (Redox)	Redox Meter	Field
pH	pH Meter	Field
Temperature	Meter	Field
Specific Conductance	Meter	Field
Alkalinity	Hach Kit AL, AP, MG-L	Field

3.2.7 Site 39: Clear Creek Floodplain

3.2.7.1 Site 39 Location and Description

Site 39 is located in the southwestern portion of the facility. The site includes the "Clear Creek Streambed" and "Clear Creek Floodplain" extending up to 200 feet on either side of the creek. The northern and southern boundaries of the site extend approximately 500 feet north of the New "A" ditch in the upstream direction to the new "S" ditch in a downstream direction.

3.2.7.2 Site 39 History

A detailed time line and discussion of the Clear Creek Floodplain history is provided in Appendix C.

3.2.7.3 Proposed Investigation

The investigation activities proposed for Site 39 are described below.

Investigation Scope

- Define extent of soil contamination that exceeds applicable FDEP regulation (e.g., Florida Soil Cleanup Goals (1998), Chapter 62-785 FAC and Soil Cleanup Target Levels from Revised Chapter 62-777 FAC, if adopted) and 62-302 Surface Water Quality Standards.

- Define extent of soil contamination that exceeds applicable "risk benchmarks" defined by USEPA [e.g., USEPA Region VI RBCs and SSLs (USEPA 1996c)].

Source Areas of Concern

- Clear Creek Streambed surface water and sediments
- Clear Creek Floodplain surface water and sediments
- Groundwater to surface water exchange within the Clear Creek Streambed and Floodplain

The RI/FS investigation at the Site 39 will be discussed as separate investigations of the Clear Creek Streambed and Clear Creek Floodplain. The Clear Creek Streambed investigation will include the collection of twenty surface water samples over the 9,000-ft length of Clear Creek from above the new "A" ditch to the new "S" ditch. Surface water samples within the Clear Creek Streambed will be collected using sample location spacing as follows. Surface water samples will be collected in the area from new "A" ditch to new '"M" ditch using a spacing of 500 feet between stations. Surface water samples collected from the area down stream of the new "M" ditch will be collected using a station spacing of 300 feet. The sample locations are shown on Plate 1. At each of the surface water sample locations a groundwater/surface water interface sample will also be collected. In addition at ten surface water locations, sediment samples will be collected for laboratory analysis.

The investigation of the Clear Creek Floodplain includes the a reconnaissance and mapping of previously identified NAPL; and, the collection of surface water, groundwater/surface water interface samples, and sediment samples at 50 locations within the floodplain. The samples will be collected along 10 transects oriented perpendicular to the stream flow. The supporting rationale for the sample collection is provided below. The proposed sample locations are shown on Plate 1.

RI/FS Rationale for Site 39 Clear Creek Streambed Sample Collection

Sample Type	Rationale
Surface Water samples	Determine influence of Facility surface water and groundwater discharge to Clear Creek. Support human health and ecological risk assessments.
Surface water/groundwater interface samples	Determine concentrations and identify preferential flow pathways for contaminants flowing from groundwater to surface water in clear creek.
Sediment samples	Determine influence of Facility surface water and groundwater discharge to Clear Creek. Support human health and ecological risk assessments.

RI/FS Rationale for Site 39 Clear Creek Floodplain Sample Collection

Sample Type	Rationale
Surface Water samples	Determine influence of Facility surface water drainage and groundwater discharge to Clear Creek. Support human health and ecological risk assessments.
Surface water/groundwater interface samples	Determine contaminant concentrations and identify preferential flow pathways for contaminants flowing from groundwater to surface water in Clear Creek. Determine concentrations at potential point of compliance.
Sediment samples	Determine influence of Facility surface water and groundwater discharge to Clear Creek. Support human health and ecological risk assessments.

Surface Water Sampling Criteria

Reconnaissance and NAPL Mapping. Initially a site reconnaissance will be conducted over the entire Clear Creek flood plain area. The reconnaissance will be conducted to identify any areas of organic sheen or NAPL discharge. In areas where an organic sheen or NAPL is identified, the location will be marked and horizontal coordinates for the location will be determined using a GPS.

Surface Water Sampling. A traditional surface water sampling investigation will be completed in Clear Creek Streambed and the Clear Creek Floodplain in the previously indicated area. The investigation will be timed to coincide with stream base flow conditions and stream gauge measurements will be recorded at the time of the investigation.

All of the surface water samples will be collected directly into the sample bottles by submerging the bottles near the bottom of the water column and removing the bottle lid. The samples will be collected following the USEPA Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, May 1996. All of the surface water samples will be shipped to a CLP laboratory for analysis of low level concentrations of TCL VOC (NEESA Level D \ USEPA level IV). This analytical method incorporates a larger sample aliquot and a modified EPA Method 524.2 to obtain Contract Required Quantitation Limits (CRQL) ranging from 1 to 5 ug/l. In addition, at thirteen of the streambed sample locations and all of the Clear Creek Floodplain locations, surface water samples will be analyzed for TCL SVOCs, TCL pesticides and PCBs, TAL inorganics and TOC. A list of the analysis to be completed is provided in Table 3-4. The surface water will also be analyzed for field analytical parameters including pH, Eh, specific conductance, temperature, dissolved oxygen, ferrous iron, and hydrogen sulfide.

Groundwater/Surface Water Interface Samples. In addition to the surface water sample collection, groundwater/surface water interchange samples will be collected at each surface water sample location on the Clear Creek Streambed and Clear Creek Floodplain. The groundwater/surface water samples will be used to evaluate the slightly deeper water flow zone below Clear Creek. The casing sampler technique will include the use of a 6-in diameter PVC casing with a peristaltic pump hose attachment. The casing will be installed 8 to 12 inches into the sediments of Clear Creek Streambed or Clear Creek Floodplain. The water within the casing will be evacuated using a peristaltic pump and teflon tubing at a low flow sampling rate. Field parameters will be recorded within the casing and surface water during purging operation in order to confirm that a short circuit does not occur. After evacuating three casing volumes, a groundwater sample will be collected through the teflon tubing using the peristaltic pump.

The groundwater to surface water interface samples will be analyzed for TCL VOCs and field analytical parameters including pH, Eh, specific conductance, temperature, dissolved oxygen, ferrous iron, and hydrogen sulfide.

Sediment Sampling. At ten of the surface water sample locations in the Clear Creek Streambed and all of the sampling locations surface water sampling locations on the floodplain, sediment samples will be collected. The sediment samples will be collected from 0 to 6 inches using a stainless steel hand auger or core barrel, whichever proves to be most effective. The samples will be collected following the USEPA SOPs and Quality Assurance Manual, May 1996. And will be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, TAL inorganics and TOC.

3.2.8 Site 40: Facility–wide Groundwater

3.2.8.1 Site 40 Location and Description

Site 40, Facility-wide Groundwater includes all groundwater underlying the NAS Whiting Field facility. The site was identified and designated in 1997 to address the large commingled groundwater contamination plumes underlying the Facility's industrial area. However, the site also includes the groundwater at the Facility's perimeter road sites and any potentially contaminated groundwater migrating off base.

3.2.8.2 Site 40 History

Site 40, Facility -wide groundwater was identified and designated as a separate site in 1997 to address the large commingled plumes of groundwater contamination underlying the Facility's industrial area. Prior to being designated as a separate site, groundwater at the facility was sampled numerous times as part of separate site specific investigations. The analytical results for the previous investigations will not be discussed here, however Table 2-1 lists the previous groundwater investigations and the sites addressed during each investigation.

3.2.8.3 Proposed Investigation

The RI/FS investigation at Site 40 will include: installation of 35 additional monitoring wells (plus 5 site-specific monitoring well previously discussed); collection of groundwater samples from each of the new monitoring wells and 24 existing monitoring wells; and completion of 33 soil borings to address potential leaching of soils to groundwater. The supporting rationale for these monitoring wells and soil borings is presented below. Plate 1 shows the approximate locations of the proposed monitoring wells. The soil boring locations will be determined during the field program. Table 3-5 summarizes the proposed drilling program for the groundwater investigation and lists the individual proposed drilling completion depths.

Soil Investigation Scope

The investigation activities proposed for soils at Site 40 are described below.

- Collect supporting data to evaluate potential for contaminated source area soils to leach to the groundwater.

Source Areas of Concern

The source areas of concern at Site 40 are listed below.

- Soil Contamination leaching to groundwater at Sites 3, 4, 6, 10, 11, 13, 14, 15, 16, 18 30, and 32.

RI/FS Rationale for Soil Borings at Site 40	
Soil Boring Locations	**Rationale**
Soil borings at monitoring well locations: WHF-1-5S, WHF-2-4S, WHF-10-3S, WHF-13-5S, and WHF-38-1S	Collect facility specific background SPLP data to establish relationship between total chemical concentrations and potential for chemicals to leach to groundwater.
Site-specific soil borings located at Perimeter Road Sites 10, 11, 13, 14, 15, 16, 18 and Industrial Area Sites 3, 4, 6, 30, & 33	Determine site-specific potential for chemicals to leach from soils to groundwater. Specific soil boring locations will be determined in the field. See Table 3-8.

Soil Sampling Criteria

Initially subsurface soil samples will be collected from soil borings at locations of proposed background monitoring wells. The background soil samples will be analyzed at a laboratory for TAL Inorganics and SPLP of the same parameters. These sample results will be used to establish a relationship between the total values for inorganic analytes and the SPLP results that may be applied to the entire facility.

TABLE 3 -5

RI/FS WORK PLAN
FOR SITES 7, 29, 36, 38, 39, 40 AND PSC 1485C
DRILLING PROGRAM SUMMARY

NAS WHITING FIELD
MILTON, FLORIDA

Type of Drilling	DPT Soil Borings		Monitoring Wells			
Site number or Investigation Area	**Contaminant Characterization - Number of borings/ depth bls**	**SPLP Analysis - Number of HSA soil borings/ depth**	**Perched (well depth)**	**Watertable (well depth)**	**Deep (Top of unnamed Clay at – 70' msl)**	**Deep (Top of Pensacola Clay at – 150' msl)**
Perimeter Road Sites						
Site 1	--	--	--	1 (80' bls)	--	--
Site 2	--	--	--	1 (90' bls)	--	--
Site 10	--	2 (30')	--	1 (120' bls)	--	--
Site 11	--	2 (30')	--	--	--	--
Site 12	--	--	--	--	--	--
Site 13	--	2 (30')	--	1 (75' bls)	1 (152' bls)	--
Site 14	--	2 (30')	--	--	--	--
Site 15	--	4 (30')	--	--	--	--
Site 16	--	4 (30')	--	--	--	--
Site 17	--	2 (30')	--	--	--	--
Site 18	--	2 (30')	--	--	--	--

See notes at end of table.

TABLE 3 - 5

RI/FS WORK PLAN
FOR SITES 7, 29, 36, 38, 39, 40 AND PSC 1485C
DRILLING PROGRAM SUMMARY

NAS WHITING FIELD
MILTON, FLORIDA

Type of Drilling	DPT Soil Borings		Monitoring Wells			
Site number or Investigation Area	**Contaminant Characterization - Number of borings/ depth bls**	**SPLP Analysis - Number of borings/ depth**	**Perched watertable (well depth)**	**Watertable (well depth)**	**Deep (Top of unnamed Clay at – 70' msl)**	**Deep (Top of Pensacola Clay at – 150' msl)**
<u>Site–Specific RI's</u>						
Site 29	2 days/30'	--	--	--	--	--
Site 36	2 days/60'	--	--	--	--	--
Site 38	8/20'	--	--	4 (90' bls)	--	--
PSC 1485C	4/20'	--	--	1 (138' bls)	--	--
Ust 1438/1439				1 (90' bls)		
North Field Hangar Area	14/100'	7 (30' bls)[1]	6 (100' bls)	--	3 (245' bls)	2 (325' bls)
Mid Field Hangar Area	--	3 (30' bls)[2]	--	--	--	--
South Field Hangar Area	--	3 (30' bls)[3]	--	--	2 (245' bls)	1 (325' bls)
Clear Creek / Facility Boundary Area	--	--	--	--	8 [4]	8 [5]
TOTAL	**26 +**	**33**	**6**	**10**	**14**	**11**

Notes:

Dpt – Direct Push Technology
msl – mean sea level
bls – below land surface
[1] = Soil borings to be completed at Sites 3, 4, and 32.
[2] = Soil borings to be completed at Site 6.
[3] = Soil borings to be completed at Site 30.
[4] = Monitoring well depths (bls) include: 105 ft, 110 ft, 125 ft, 135 ft, 150 ft, 160 ft, 200 ft & 210 ft.
[5] = Monitoring well depths (bls) include: 185 ft, 190 ft, 205 ft, 215 ft, 240 ft, 280 ft & 290 ft.

Following the background sample collection, additional samples will be collected at specific RI sites where existing data indicates exceedances of FAC 62-777 leachability screening values. These samples will be analyzed for SPLP in the following manner:

- For chemicals with screening values (most organic chemicals), additional soil samples will be collected from the specific location and depth interval where exceedances were reported and analyzed via SPLP for the specific analyte. The individual exceedances and locations are provided in Tables 3-6 and 3-7. The SPLP analysis will be held until the total TAL analysis is determined and the elevated concentrations of the specific analyte are confirmed.

- For chemicals without screening values (most inorganic analytes), additional soil samples will be collected at representative, but not at the specific location or depth of the exceedances reported and analyzed via SPLP for the specific analyte. Representative sample locations will typically be at the location of an organic chemical.

At sites where a site-specific investigations of soils is being completed (e.g. Sites 7, 29, 36, 38, and PSC 1485C), soil samples will be collected for SPLP analysis. However, the SPLP analysis will only be completed for those chemicals that exceed either published leachability screening values (FAC 62-785) or exceed the facility-specific values for those chemicals that a facility-specific value has been determined.

All DPT soil borings will be drilled to a minimum depth of 30 feet bls. In each soil boring, three subsurface soil samples will be selected for laboratory analysis based on high OVA readings, changes in lithology, or at the discretion of the site geologist based on other field observations. Soil samples will be analyzed for total analysis and SPLP analysis for the parameters indicated on Tables 3-6 and 3-7.

Groundwater Investigation Scope

The investigation activities proposed for groundwater at Site 40 are described below.

- Characterize extent of groundwater contamination that exceeds regulatory criteria (e.g., USEPA and Florida MCLs) for the commingled plumes at the Industrial Area and perimeter road sites.
- Identify and characterize extent of NAPL and groundwater contamination in perch water zone at the North Field Hangar Area.
- Collect supporting data to evaluate background metals concentrations for sites located on the Perimeter Road.
- Collect supporting data to evaluate risk and natural attenuation of groundwater plume.

TA… 3 - 6
RI/FS WORK PLAN
FOR SITES 29, 36, 38, 39, 40, and PSC 1485C
INDUSTRIAL AREA SPLP SAMPLING SUMMARY
NAS WHITING FIELD, MILTON FLORIDA

Site No.	Contaminant of Concern	Frequency of Detection/ # Samples	Range of Detected Analyte Concentrations (mg/kg)	Location of Maximum Concentration	Background Screening Value (mg/kg)	FAC 62-777 Leachability (mg/kg)
3	dieldrin	2/30	0.001/ 0.026	3SB1-5-7(93)	ND	0.004
	aluminum	29/30	214/59600	3SB6-5-7(93)	13,917	NA
	cobalt	6/30	0.87/3.2	3SB1-5-7(93)	0.74	NA
	copper	25/30	0.36/11.1	3SB5-10-12(93)	4.4	NA
	iron	30/30	86.1/32600	3SB2-5-7(93)	9,055	NA
	lead	28/30	0.6/8.3	W03SB01201	4.2	NA
	manganese	30/30	0.88/39.4	3SB5-5-7(93)	21.3	NA
4	benzene	1/24	0.77	W04SB00103	ND	0.007
	chloromethane	1/24	0.017	W04SB00602	ND	0.01
	ethlybenzene	8/24	0.002/13	W04SB00602	ND	0.6
	methylene chloride	1/24	0.069	W04SB00104	ND	0.02
	toluene	5/24	0.001/20	W04SB00602	ND	0.5
	xylenes (total)	11/24	0.002/46	W04SB00602	ND	0.2
	2-methylphenol	3/24	0.047/0.31	W04SB00602	ND	0.2
	4-methylphenol	3/24	0.072/0.5	W04SB00602	ND	0.2
	N-nitroso-di-n-propylamine	6/24	0.014/0.061	W04SB00302-D	ND	0.04
	aluminum	24/24	366/29600	W04SB00702	13,917	NA
	copper	8/24	0.55/9	W04SB00902-D	4.4	NA
	iron	24/24	57.3/22400	W04SB00902	9,055	NA
	lead	24/24	0.51/15.3	W04SB00702-D	4.2	NA
	manganese	21/24	0.67/116	W04SB00902	21.3	NA

NA Site specific leachabiity values to be derived using the SPLP or TCLP test.
SPLP Synthetic Precipitation Leaching Procedure

TABLE 3 - 6
RI/FS WORK PLAN
FOR SITES 29, 36, 38, 39, 40, and PSC 1485C
INDUSTRIAL AREA SPLP SAMPLING SUMMARY
NAS WHITING FIELD, MILTON FLORIDA

Site No.	Contaminant of Concern	Frequency of Detection/ # Samples	Range of Detected Analyte Concentrations (mg/kg)	Location of Maximum Concentration	Background Screening Value (mg/kg)	FAC 62-777 Leachability (mg/kg)
6	trichloroethene	1/14	0.073	6SB3-117-119(92)	ND	0.03
	dieldrin	1/14	0.013	6SB1-5-7(92)	ND	0.004
	aluminum	14/14	175/39800	6SB2-15-17(92)	13,917	NA
	chromium	13/14	1.1/39.4	6SB2-15-17(92)	11.4	38
	copper	14/14	0.44/10.3	6SB2-15-17(92)	4.4	NA
	iron	14/14	237/18900	6SB1-15-17(92)	9,055	NA
	lead	14/14	0.19/21.1	6SB1-5-7(92)	4.2	NA
	manganese	14/14	0.77/73.7	6SB1-5-7(92)	21.3	NA
30						
	trichloroethene	4/36	0.001/0.16	30SB1-5-7(92)	ND	0.03
	N-nitroso-diphenylamine	1/36	0.71	30SB00303	ND	0.4
	naphthalene	4/36	0.046/20	30SB04-5-7(93)	ND	1.7
	aluminum	23/23	105/41800	W30SB01201	13,917	NA
	cobalt	5/23	1/2.3	30SB6-10-12(93)	0.74	NA
	copper	18/23	0.48/9.1	W30SB01201	4.4	NA
	iron	23/23	67/24500	W30SB01201	9,055	NA
	lead	21/23	0.23/22	30SB04-5-7(93)	4.2	NA
	manganese	22/23	0.29/177	30SB1-5-7(92)	21.3	NA
	TPH	23/33	2.7/21200	30SB04-5-7(93)	ND	340

NA Site specific leachabiity values to be derived using the SPLP or TCLP test.
SPLP Synthetic Precipitation Leaching Procedure

TA. 3 - 6
RI/FS WORK PLAN
FOR SITES 29, 36, 38, 39, 40, and PSC 1485C
INDUSTRIAL AREA SPLP SAMPLING SUMMARY
NAS WHITING FIELD, MILTON FLORIDA

Site No.	Contaminant of Concern	Frequency of Detection/ # Samples	Range of Detected Analyte Concentrations (mg/kg)	Location of Maximum Concentration	Background Screening Value (mg/kg)	FAC 62-777 Leachability (mg/kg)
32						
	1,2-DCE (total)	3/74	0.002/0.43	WRSB01(5-7)	ND	.4/.7
	benzene	4/74	0.017/1.4	WR-SB03(15-17)	ND	0.007
	chloromethane	2/74	0.002	W32SB01603	ND	0.01
	ethlybenzene	9/74	0.001/5.1	WR-SB01(5-7)-D	ND	0.6
	methylene chloride	8/74	0.004/0.61	WR-SB01(5-7)-D	ND	0.02
	tetrachloroethene	3/74	0.39/1.7	WR-SB01(5-7)-D	ND	0.03
	toluene	9/74	0.002/13	WR-SB01(5-7)	ND	0.5
	trichloroethene	3/74	0.005/1.3	WR-SB01(15-17)	ND	0.03
	xylenes (total)	13/74	0.008/32	WR-SB01(5-7)	ND	0.2
	naphthalene	14/74	1.1/26	WR-SB01(5-7)	ND	1.7
	aluminum	62/62	6.9/33200	32SB5-5-7(93)	13,917	NA
	cobalt	11/62	0.51/2.5	32SB7-5-7(93)	0.74	NA
	copper	45/62	0.49/8.4	32SB6-10-12(93)	4.4	NA
	iron	62/62	29.8/16000	32SB5-5-7(93)	9,055	NA
	lead	60/62	0.13/6.4	W32SB01604	4.2	NA
	manganese	53/62	0.21/53.5	32SB5-5-7(93)	21.3	NA
	TPH	9/42	2.0/2650	32SB7-30-32(93)	ND	340
33						
	ethylbenzene	1/36	1.5	33SB2-5-7(92)	ND	0.6
	xlyenes (total)	3/36	0.002/4.8	33SB2-5-7(92)	ND	0.2
	dieldrin	1/28	0.013	33SB2-2-4(92)	ND	0.004
	aluminum	28/28	36.8/47800	33SB5-5-7(92)	13,917	NA
	chromium	27/28	0.85/70	W33SB01201	11.4	38
	cobalt	6/28	1.3/1.8	33SB4-3-5(92)	0.74	NA
	copper	27/28	0.54/11.1	33SB5-5-7(92)	4.4	NA
	iron	28/28	67.4/22300	33SB5-5-7(92)	9,055	NA
	lead	37/38	0.26/24.3	33SB2-5-7(92)	4.2	NA
	manganese	28/28	0.32/169	33SB4-3-5(92)	21.3	NA
	TPH	20/32	2.1/7790	33SB2-5-7(92)	ND	340

NA Site specific leachabiity values to be derived using the SPLP or TCLP test.
SPLP Synthetic Precipitation Leaching Procedure

TABLE 3 - 7
RI/FS WORK PLAN
FOR SITES 29, 36, 38, 39, 40, and PSC 1485C
PERIMETER ROAD SPLP SAMPLING SUMMARY
NAS WHITING FIELD, MILTON FLORIDA

Site No.	Contaminant of Concern	Number of Soil Borings	Number of Soil Samples	Frequency of Detection/ No. Samples	Range of Detected Analyte Concentrations (mg/kg)	Exceeds Groundwater MCLs (yes/no)	Background Screening Value (mg/kg)	FAC 62-777 Leachability (mg/kg)	GIR Background Screening Value (mg/kg)
1	lead	0	0	7/8	3.5/44	no	11.4	NA	8.6
2	manganese	0	0	6/6	1.7/53.5	no	42.6	NA	40.6
10	dieldrin	2	6	1/3	0.005	no	ND	0.004	
	antimony			1/3	7.9	no	4.4	5	
	beryllium			3/3	0.16/0.4	no	0.26	63	
	chromium (VI)			3/3	11.2/207	no	22.8	38	
	cobalt			1/3	2.5	no	1.48	NA	1.46
	copper			3/3	4.5/11.9	no	8.8	NA	8.2
	iron			3/3	7,495/44,600	no	18,100	NA	16,540
	lead			3/3	13.85/82.4	no	8.4	NA	8.6
	manganese			3/3	13.3/124	no	42.6	NA	40.6
	selenium			1/3	0.585	no	0.3	5	
	vanadium			3/3	19.8/104	no	45	6,000	
	zinc			3/3	19.4/27.3	no	15.6	12,000	
11	dieldrin	2	6	3/3	0.002/0.033	no	NA	0.004	
	cobalt			3/3	1.1/1.7	no	1.48	NA	1.46
	copper			3/3	5.9/17.2	no	8.8	NA	8.2
	lead			3/3	7.4/109	no	8.4	NA	8.6
	manganese			3/3	20.6/188	yes	42.6	NA	40.6
12	cobalt	0	0	5/10	1.1/1.6	no	1.5	NA	1.46
	lead			10/10	3.8/29.9	no	8.4	NA	8.6
	manganese			10/10	6.3/222	no	42.6	NA	40.6
13	phenol	2	6	1/3	0.13	no	NA	0.05	
	4-methylphenol			2/3	0.068/1.095	no	NA	0.02	
	mercury			3/3	0.16/2.14	no		2.1	

NA Site specific leachabiity values to be derived using the SPLP or TCLP test.
SPLP Synthetic Precipitation Leaching Procedure

PERIMETER ROAD SPLP SAMPLING SUMMARY
NAS WHITING FIELD, MILTON FLORIDA

Site No.	Contaminant of Concern	Number of Soil Borings	Number of Soil Samples	Frequency of Detection/ No. Samples	Range of Detected Analyte Concentrations (mg/kg)	Exceeds Groundwater MCLs (yes/no)	Background Screening Value (mg/kg)	FAC 62-777 Leachability (mg/kg)	GIR Background Screening Value (mg/kg)
14	xylenes (total)	2	6	1/2	0.26	no	NA	0.2	
	cadmium			1/2	1.7	no	0.92	NA	
	iron			2/2	15,300/18,800	no	18,100	NA	16,540
15	copper	4	12	8/30	1.6/12.5	no	9.4	NA	8.2
	lead			30/30	2.3/59.9	no	11.4	NA	8.6
	manganese			30/30	8.8/143	yes	404 ?	NA	40.6
16	methylene chloride	4	12	1/5	0.0865	no	ND	0.02	
	antimony			3/5	2.5/6.7	yes		5	
	cadmium			3/5	2.4/9	yes		8	
	cobalt			5/5	1.1/9.6	no	1.48	NA	1.46
	copper			5/5	4.8/3,620	no	8.8	NA	8.2
	iron			5/5	6,670/74,800	yes	18,100	NA	16,540
	lead			5/5	6.8/766	no	8.4	NA	8.6
	manganese			5/5	46.95/638	yes	42.6	NA	40.6
18	xylenes(total)	2	6	4/26	0.016/7.15	no	NA	0.02	
	2-methylnaphthalene			9/26	0.136/33	no	NA	6.1	
	4-methyphenol			3/26	0.11/0.265	no	NA	0.02	
	naphthalene				0.23/15	no	NA	1.7	
	phenol			2/26	0.945	no	NA	0.05	
	TPH			11/13	2.3/6,300	no	NA	340	
	lead			25/26	0.3/14.5	no	8.4	NA	8.6
	manganese			26/26	0.44/63	yes	42.6	NA	40.6

NA Site specific leachabiity values to be derived using the SPLP or TCLP test.
SPLP Synthetic Precipitation Leaching Procedure

Source Areas of Concern

The source areas of concern at Site 40 are listed below.

- Perched water table zone in the North Field Hangar area.
- Contaminated groundwater in the sand-and-gravel aquifer in the North Field Hangar area.
- Contaminated groundwater in the sand-and-gravel aquifer in the Mid Field and South Field Hangar area.
- Contaminated groundwater in the sand-and-gravel aquifer at perimeter road Sites 1, 2, 9, 11, 13, and 14.
- Contaminated groundwater in the sand-and-gravel aquifer migrating across facility boundaries.
- Contaminated groundwater in the sand-and-gravel aquifer at UST Site 438/1439.

RI/FS Rationale for Monitoring Wells Installation at Site 40

Monitoring Well Location	Rationale
WHF-1466-17D3, WHF-1467-14D3 & D4, WHF-1467-16D3 & D4, WHF-1466-8D3 & D4, and WHF-1466-9D3 & D4	Deep wells and deep well pairs at existing shallow well locations: to investigate vertical extent of contamination above the unnamed clay and Pensacola Clay near the source area; additional potentiometric control points to determine deep groundwater flow directions.
WHF-1466-21D3 & D4, WHF-1466-24D3 & D4, WHF-1466-25D3 & D4, WHF-15-8D3, WHF-16-7D3 & D4, and WHF-13-3D3	Deep wells and deep well pairs at existing shallow well locations: to Investigate downgradient extent of groundwater contamination and potential for off-facility plume migration.
WHF-OW-1D3 & D4, WHF-OW-3D3 & D4, and WHF-0W-5D3 & 5D4	Deep wells and deep well pairs at existing shallow well locations: to investigate downgradient extent of groundwater contamination under Clear Creek; additional potentiometric control points to determine intermediate and deep groundwater flow directions.
WHF-32-12P, WHF-32-13P, WHF-32-14P, WHF-32-15P, WHF-32-16P, and WHF-32-17P	Perched aquifer zone monitoring wells to investigate extent of groundwater contamination in perched groundwater.
WHF-1-5S, WHF-2-4S, WHF-10-3S, and WHF –13-5S	Shallow wells to determine site-specific background concentrations in shallow aquifer zone and derive facility specific background values for soil leaching to

Groundwater Sampling Criteria

Groundwater samples from each of the new monitoring wells will be collected and analyzed for TCL VOCs, TCL SVOCs, TPH, TAL inorganics, PCBs, pesticides, and natural attenuation parameters. In addition, groundwater samples from selected existing monitoring wells will be collected and analyzed for contaminants TCL VOCs and natural attenuation indicator parameters. The analyses to be performed on groundwater samples from both the proposed new wells and existing wells are shown on Table 3-4. Natural attenuation and water quality parameters to be analyzed are shown below.

RI/FS Rationale for Monitoring Wells Sampling at Site 40

Monitoring Well Location	Rationale
35 additional monitoring wells to be installed	See rationale in Box.
Existing North Field Hangar area monitoring wells including WHF-1467-2D, WHF-1467-9, WHF-1467-20, WHF-1467-21, WHF-1467-24, WHF-1467-28, WHF-1467-31,WHF-32-8D, WHF-32-9D, WHF-32-1, WHF-3-4, and WHF-3-7S	To evaluate contaminated groundwater concentration changes and potential for natural attenuation.
Existing South Field Hangar area monitoring wells including WHF-1466-6DD, WHF-1466-7, WHF-1466-8DD, WHF-1466-12, WHF-1466-13, WHF-1466-16, WHF-1466-17,WHF-1466-20, WHF-5-9S, WHF-6-1S, WHF-7-1S, and WHF-30-4	To evaluate contaminated groundwater concentration changes and potential for natural attenuation.
Point of Compliance Monitoring wells including WHF-OW-1S,I,D; WHF-OW-3S,I,D; WHF-OW-5S,I,D;WHF-16-7S,I,D;WHF-15-8S,I,D; and WHF-1466-21S,I,D	Determine if potential contamination is discharging to Clear Creek or migration under the Clear Creek to off facility property.

Groundwater Natural Attenuation and Water Quality Parameter Analyses		
Parameter	**Test Method**	**Test Location**
Dissolved Oxygen (DO)	DO Meter (DO >0.5 mg/L) Field Titration Kit (DO <0.5 mg/L)	Field
Nitrate	E300	Laboratory
Iron II (Fe^{+2})	Hach Method 8146	Field
Sulfate	E300	Laboratory
Sulfide	E300	Laboratory
Methane	SW3810, Modified	Laboratory
Oxidation-Reduction Potential (Redox)	Redox Meter	Field
pH	pH Meter	Field
Temperature	Meter	Field
Specific Conductance	Meter	Field
Dissolved Organic Carbon	SW9060	Laboratory
Alkalinity	Hach Kit AL, AP, MG-L	Field
Chloride	E300 or SW9050	Laboratory

3.2.9 Quality Assurance/Quality Control Samples

All environmental sampling will be performed in accordance with procedures outlined in the COMPQAP. QC samples including equipment blanks, trip blanks, and field duplicates will be collected as indicated below. The frequency indicated below is a departure for the methodology outlined in Section 9.1 of the COMPQAP (TtNUS 1997). The modified frequency for the QC sampling program is based on USEPA SOP (USEPA 1996) and justified by the lack of significant QA concerns recorded in the extensive historic investigations completed at the facility. Field blank samples will be collected at the same frequency as equipment blanks.

Number of Samples	**Precleaned Equipment Blank**	**Field-Cleaned Equipment Blank**	**Trip Blank (VOCs)**	**Duplicate**
10+	minimum of one, then one per week	minimum of one, then one per week	one per cooler	minimum of one, then 5%
5-9	one*	one*	N/A	One
<5	one*	one*	N/A	not required

*Note: For nine or fewer samples, a precleaned equipment blank and/or a field-cleaned equipment blank is required. A field-cleaned equipment blank must be collected if equipment is cleaned in the field.

3.2.10 Sampling Summary

Waste characterization samples will be collected from the investigation-derived soil and water. An estimated 10 soil samples will be collected and analyzed for TCLP parameters to determine the appropriate method of disposal. Several soil samples will be collected from the staged soil that is most likely to be impacted based on the location of the boring and observations recorded during drilling (i.e., headspace readings, visual observations, and odors). Additional soil samples will be collected from the staged soil that is less likely to be impacted based on the location of the boring and observations recorded during drilling.

Water samples will be collected and analyzed for TCLP from each of the tanks used to contain and store investigation-derived water. Investigation-derived water will be containerized and segregated in the following categories: decontamination fluids, development and purge water from wells with low probabilities of highly impacted groundwater, and development and purge water from wells with high probabilities of highly impacted groundwater.

A summary of the RI/FS sampling and analysis program is presented in Tables 3-3, 3-4, 3-5.

4.0 SAMPLE ANALYSES AND VALIDATION

4.1 DATA VALIDATION

The approach to providing reliable data that meet the DQOs will include QA/QC requirements for each type of analytical data generated during the field investigation. The QA/QC efforts for laboratory analyses will include collection and submittal of QC samples and the assessment and validation of data from the subcontract laboratories. Analytical data will be subjected to independent data validation in accordance with the following guidelines:

- *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA 1994d).
- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (USEPA 1994e).
- *Navy Installation Restoration Laboratory Quality Assurance Guide* (NFESC 1996).

Sample Analysis

Samples collected during the field activities will be analyzed in accordance with the DQOs established in Section 2.0. The number of samples (including QA/QC samples) and analyses planned for the NAS Whiting Field investigation are summarized in Section 3.0.

Data quality indicators include the precision, accuracy, representativeness, comparability, and completeness parameters. These parameters will be used within the data validation process to evaluate data quality. The achievable limits for these parameters vary with the DQO level of the data. The limits used for laboratory analytical data in this program will be those set by the CLP for Level D DQOs.

4.2 DATA EVALUATION

The purpose of this task is to assess the usability of validated data results based upon data comparisons to non-site-related conditions. Results that meet the DQO requirements and are considered usable will be compared to background sampling results. Results of the data evaluation will be documented in the report. The following data evaluations and comparisons will be made:

- Evaluation of detection limits
- Evaluation of counting errors
- Evaluation of equilibrium data
- Evaluation of qualified data
- Comparison of laboratory and field blanks to sample results
- Comparison of laboratory and field duplicate results

COPCs will be identified through evaluation of the following criteria:

- Background sampling results
- Frequency of detection
- Extent of contamination

COPCs will be used throughout the data evaluation, fate and transport assessment, risk assessment, and FS.

Statistical analyses will be used in the data evaluation process and will involve a variety of analytical methods including exploratory analyses and the use of the standard *t* test and/or the Mann-Whitney test. The following paragraphs briefly describe each of the methods along with its application.

Exploratory analyses may include evaluation of tables and graphs, including histograms, probability plots, and boxplots. Histograms and probability plots are used to understand and classify data distributions. In addition, tables of descriptive statistics (e.g., frequency of detection, minimum, quartiles, mean, maximum) may be evaluated. These tables alone may provide an adequate understanding of the distributions of some analytes, particularly those with few detected concentrations. Boxplots are used for side-by-side comparisons of different data sets (e.g., background versus potentially contaminated media); they graphically indicate quartiles, means, potential outliers, and properties such as skew in distributions.

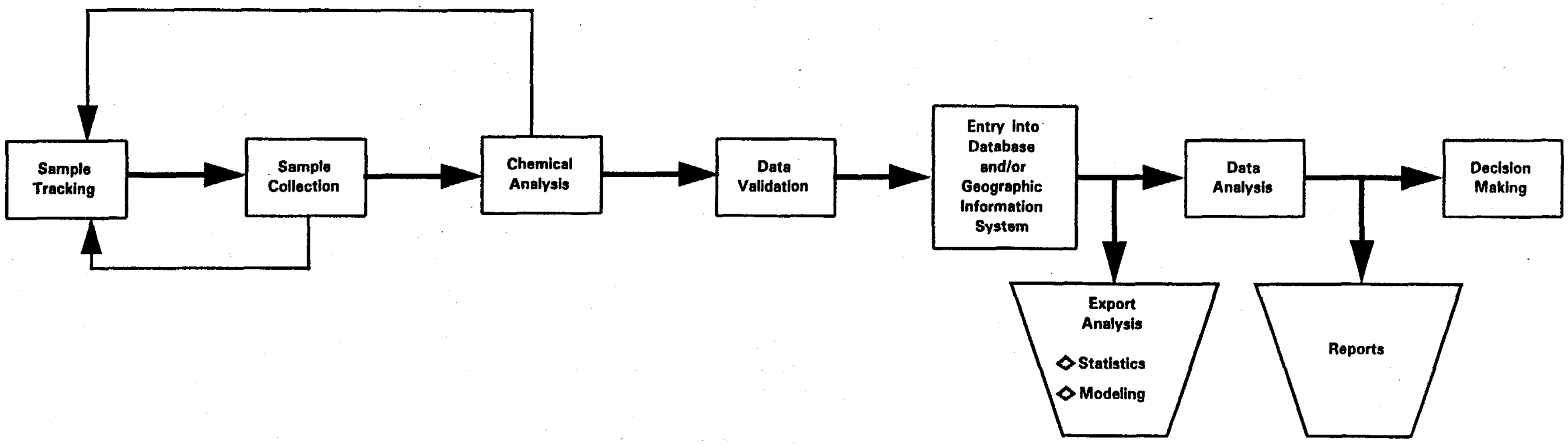
Background will be compared to site data using several numerical approaches in addition to the graphical techniques described above. Site data will be compared to two times the background mean as well as the background maximum and other descriptive statistics. If necessary, statistical testing will be performed using the *t* test, Mann-Whitney test, or both. Results of the *t* test will be used when the data have a normal distribution or can be made to approximate the normal through transformation (taking the logarithm of each datum transforms a lognormal distribution to the normal). Results of the Mann-Whitney test will be used when at least one of the distributions being compared cannot be classified. Although not required to draw conclusions about the difference between background and site data, performing both tests simultaneously can provide a better understanding of the distributional patterns affecting test results.

4.3 DATA MANAGEMENT

The purpose of this task is to track and manage environmental and QC data collected during the field investigation from the time the data are obtained through data analysis and report evaluation. Coordination and management of environmental and QC sample analysis by the contracted laboratories is also part of this task. Field activities generate data including sample locations, measurements of field parameters, and the results of laboratory analyses. Reports regarding the collection and analyses of sample data will also be generated. The process entails the flow of data collected in the field and generated by the analytical laboratory work to those involved in project evaluation and decision making. Figure 4-1 illustrates the data management life cycle and project information flow. Management of data collected during field activities will ensure accessibility of data to support environmental data analysis, risk assessments, and the evaluation of remedial action alternatives.

Samples will be tracked from field collection activities to analytical laboratories following standard chain-of-custody procedures. Sample information recorded on the chain-of-custody forms will be transferred (electronically or manually) into the sample tracking portion of the database management system (DMS), thereby enabling the samples to be tracked through final disposition.

Analytical results, applicable QA/QC data, validation flags, chain-of-custody information, and any other applicable information will be incorporated into the DMS. All data will be verified after uploading to ensure completeness and accuracy.



Legend

Flow Path

Tracking Routine

FIGURE 4-1

DATA MANAGEMENT FLOW PATH

RI/FS WORK PLAN

NAS WHITING FIELD

MILTON, FLORIDA

5.0 BASELINE RISK ASSESSMENT

5.1 HUMAN HEALTH RISK ASSESSMENT

The human health risk assessment (HHRA) for Sites 7, 29, 36, 39, and 40 at NAS Whiting Field will be performed to characterize the risks (current and future) associated with potential human exposures to site-related contaminants. The process consists of six basic components: (1) data evaluation and summarization, (2) selection of COPCs, (3) exposure assessment, (4) toxicity assessment, (5) risk characterization, and (6) uncertainty analysis. A brief description of each component is presented in the following subsections.

The HHRA will be conducted according to CERCLA methodology. The following federal and USEPA Region IV guidelines are some of the primary references used to direct and support the HHRA:

- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)* (USEPA 1989a).
- *Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment* (USEPA 1995b).
- *Exposure Factors Handbook* (USEPA 1997a).
- *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance "Standard Default Exposure Factors", Interim Final* (USEPA 1991b).
- *Dermal Exposure Assessment: Principles and Applications, Interim Report* (USEPA 1992C).
- *Guidance for Data Usability in Risk Assessment* (Part A) (USEPA 1992b).
- *Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments).* (USEPA 1998a)

The HHRA also considers the following FDEP standard:

- *Florida Administrative Code, Chapter 62-785* (this Chapter will be replaced by Chapter 62-777, when adopted)

Preliminary screening evaluations will be conducted to indicate the nature and extent of chemical contamination at the sites. The findings will be used to determine whether a full baseline risk assessment is needed, or whether the modified version of the process described below is more appropriate.

5.1.1 Data Evaluation and Summary

The data used in the risk assessment are the results from analyses conducted under the CLP protocol with documented QA/QC procedures. Before analytical results are released by the laboratory, both the sample and QC data are carefully reviewed to verify sample identity, instrument calibration, detection limits, dilution factors, numerical computations, accuracy of transcriptions, and chemical interpretations. The QC data are reduced, spike recoveries are included in control charts, and the resulting data are reviewed to ascertain whether they are within the laboratory-defined limits for accuracy and precision. Any nonconforming data are discussed in the data package cover letter and case narrative.

The data will then be reviewed and validated in accordance with *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program* (NEESA 1988) and *Navy Installation Restoration Laboratory Quality Assurance Guide* (NFESC 1996). The data review and validation process is independent of the laboratory's checks.

5.1.1.1 Evaluation of Quantitation Limits

Sample quantitation limits (SQLs) are compared to corresponding standards and criteria. For soil, SQLs will be compared to the USEPA RBCs and FDEP Soil Cleanup Goals. The groundwater SQLs will be compared to federal and state MCLs and Florida guidance concentrations. SQLs in excess of the appropriate screening value represent an area of uncertainty in the analytical results. The effect of this uncertainty will be noted in the risk assessment.

5.1.1.2 Evaluation of Qualified and Coded Data

The laboratories and data validators may attach qualifiers and codes to the analytical data. The qualifiers may pertain to QA/QC variances in identification or quantitation of an analyte. When data have both laboratory and validation qualifiers, the validation qualifiers supersede the laboratory qualifiers. All unqualified positive detections and "J" qualified detections (estimated values) are considered as detected concentrations for the HHRA. All nondetects (indicated with a "U" qualifier) are retained in the HHRA data set; this includes samples with a "UJ" qualifier. If an analyte has all nondetect results for all samples in a given medium, it is not considered in the risk assessment for that medium. Any samples with a "UR" qualifier (indicating a rejected nondetection) or "R" qualifier (indicating a rejected positive detection) are not included in the HHRA data set because these values have been rejected and are unusable.

5.1.1.3 Evaluation of Tentatively Identified Compounds

Tentatively identified compounds (i.e., both identity and concentration are uncertain) will be reviewed. The uncertainty in the identities and concentrations of these analytes will be discussed in the uncertainty analysis.

5.1.1.4 Data Used in the Risk Assessment

The product of the data evaluation is a summary of usable data for each medium. This summary includes the frequency of detection, the arithmetic mean (using only samples with detected concentrations), the range of detected concentrations, the arithmetic mean of background concentrations, and the range of the quantitation limits. The summary information is used to select human health chemicals of potential concern (COPCs) as described in Section 5.1.2. The exposure point concentrations (EPCs) of COPCs are determined as described in Section 5.1.3.3.

5.1.2 Identification of Human Health Chemicals of Potential Concern (COPCs)

COPCs are selected from all analytes detected at a site. The selection of COPCs from all detected analytes in each medium is based on the analyte concentrations, frequency of detection, comparison to background (inorganics only), and comparison to USEPA and Florida medium-specific screening criteria. COPCs include contaminants that are

- Positively identified in at least one sample.
- Detected at levels significantly above blank concentrations.

Chemicals that do not contribute significantly to human health risks are removed or "screened" from further consideration as COPCs, as recommended by USEPA (USEPA 1989a). Analytes are excluded as COPCs if they meet any of the criteria below.

- The maximum detected concentration of an analyte in a medium is less than twice the arithmetic mean of the background concentration (inorganics only) (USEPA 1995a).

- The maximum analyte concentration in a medium is less than the USEPA Region III RBC and less than the State of Florida criteria and guidance values.

- USEPA Region III RBCs corresponding to an excess lifetime cancer risk (ELCR) of 1 x 10^{-6} or hazard quotient (HQ) of 0.1 for each analyte detected are used in the screening process. For noncarcinogenic chemicals the USEPA Region III RBC values (October 1,1998) will be divided by 10 to represent an HQ of 0.1.

- For surface and subsurface soil, the residential soil RBCs are used. No RBC is available for lead in soil due to a lack of toxicity data. Based on the USEPA recommendation, a residential screening level of 400 mg/kg is used as the RBC for lead in soil (USEPA 1994a).

- For groundwater, tap water RBCs are used. No RBC is available for lead in groundwater; therefore, the treatment technology action level for drinking water of 15 μg/L (Safe Drinking Water Act action level) is used (USEPA 1994b; FDEP 1994).

- FDEP Soil Cleanup Criteria based on the aggregate resident are used to screen surface soil (FDEP 1995). For subsurface soil, State of Florida cleanup criteria based on leachability are used for screening. The target HQ for noncarcinogenic substances is 1.0, while the target cancer risk is 1 x 10^{-6} in the soil cleanup criteria. For groundwater, Florida guidance concentrations are used for screening.

- The average concentration of an essential nutrient (e.g., sodium, potassium, magnesium, and calcium) in a medium is below a toxic screening level and consistent with or only slightly above the background concentration for that essential nutrient.

- The frequency of detection (i.e., the number of samples in which the analyte is detected divided by the number of samples analyzed for that analyte) is sufficiently low and professional judgment is used to ensure that the analyte is probably an anomaly. A chemical is considered a candidate for exclusion if (1) it had a low frequency of detection (e.g., less than 5 percent), (2) is not detected in other sampled media or at high concentrations (i.e., contaminated “hot spots” do not exist), and (3) there is no reason to believe that the chemical may be present (USEPA 1989b).

Tentatively identified compounds are screened based on their suspected presence at the sites under consideration, the contaminant concentration, the migration potential via each of the identified exposure pathways, and the chemical's toxicity. The tentatively identified compounds of concern are evaluated qualitatively in the HHRA.

5.1.3 <u>Exposure Assessment</u>

The exposure assessment estimates the types and magnitudes of potential human exposure to COPCs. This process involves three steps:

- Characterization of the exposure setting in terms of physical characteristics and the populations that may potentially be exposed to site-related chemicals,
- Identification of exposure pathways and receptors, and
- Quantification of exposures for each population in terms of the amount of chemical that is either ingested, inhaled, or absorbed through the skin from all potentially complete exposure pathways.

5.1.3.1 Characterization of Exposure Setting

The physical characteristics of the site and the nature of the surrounding populations are evaluated to provide a basis for assessing potential exposures. The HHRA summarizes important site characteristics that may influence human contact with site contaminants including surface conditions, soil type, degree of vegetative cover, climate, geology, and conditions that affect the migration of contaminants, such as speed and direction of groundwater flow.

The evaluation of population characteristics includes the location of current populations relative to the site and the daily activities of these populations. The presence and location of potentially sensitive subpopulations, such as children or the elderly, are also evaluated. Potential future populations are also considered.

5.1.3.2 Identification of Exposure Pathways and Receptors

This step involves the identification of all relevant exposure pathways through which specific populations may be exposed (currently or in the future) to contaminants at the site. An exposure pathway consists of four necessary elements: (1) a source or mechanism of chemical release, (2) a transport or retention medium, (3) a point of human contact, and (4) a route of exposure at the point of contact (USEPA 1989a).

The first step in defining potential exposure pathways is to identify all sources of contamination (e.g., groundwater and soil). Once sources are identified, relevant fate and transport mechanisms are evaluated to predict current and potential future exposures. Population characteristics are then used to identify where people may come into contact with contaminated media and the possible routes of exposure (i.e., inhalation, ingestion, or dermal absorption). The receptors to be evaluated are selected based on the current and realistic future use of the sites and surrounding areas. The human receptors that will be considered during the baseline HHRA of Sites 7, 29, 36, 39, and 40 are (1) military residents, both a young child (age 1-6) and an adult; (2) future residents, both a young child (age 1–6) and an adult; (3) trespassers, both an older child (age 7–16) and an adult; (4) a construction worker; (5) site occupational workers, and (6) a recreational user, both a young child (age 1-6) and an adult. These receptors are described below.

- **Military residents** are individuals who live on base with their families during their tour of duty at NAS Whiting Field. Typically, a tour of duty is three years. These residents use groundwater extracted from NAS Whiting Field's on-base water supply wells; however, NAS Whiting Field treats the groundwater using activated carbon at the well head. Even though the groundwater is treated, to be conservative, exposure to groundwater COPCs will be evaluated in the HHRA.

- **Future residents** are individuals who may currently reside near Sites 7, 29, 36, 39, or 40 or may do so in the future. These residents may come into direct contact with contaminants in surface soils and may rely on the groundwater aquifer as a domestic water supply.

- **Trespassers** are individuals who may from time to time enter a contaminated site without proper authorization and come into contact with contaminated soil.

- **Construction workers** are individuals who may come into contact with surface soils, subsurface soils, or groundwater while excavating or performing construction activities near contaminated sites. Construction workers may also come into contact with surface water or sediment while performing construction activities at Site 39.

- **Site occupational workers** are individuals who, during their 8-hour work shifts, may come into contact with contaminated surface soils or may use groundwater as a domestic-type water supply. Exposure of site occupational workers is very task-dependent. For example, the exposure of office workers to site-related contaminants may be much lower than the exposure of landscapers to such contaminants.

- **Recreational users** are individuals who may come in contact with contaminated surface water or sediment during recreational activities, such as swimming or wading, at Site 39.

Table 5-1 identifies the exposure pathways to be evaluated for the current land use population scenarios at Sites 7, 29, 36, 39, and 40, whereas Table 5-2 identifies the exposure pathways to be evaluated for the future land use population scenarios at those sites. Currently, Site 29 is largely covered with asphalt or concrete, but has a small grassy area; and Site 7 is an uncovered parking area, therefore, soil exposure will be considered for a trespasser (older child and adult), site occupational worker, and construction worker under current conditions. Currently, Site 36 is completely covered with asphalt or concrete;

TABLE 5-1

PROPOSED HUMAN HEALTH RECEPTORS TO BE EVALUATED FOR CURRENT LAND USE AT SITES 5, 7, 29, 35, 39, AND 40 [(a)]
RI/FS PHASE II-C WORK PLAN FOR
SITES 5, 7, 29, 35, 39, AND 40
NAS WHITING FIELD
MILTON, FLORIDA

Site	Name	Current Land Use Receptors	Exposure Media	Exposure Routes
Site No. 29 Site No. 7	Auto Hobby Shop South AVGAS Tank Sludge Disposal Area	Trespasser (older child and adult) Site Occupational Worker Construction Worker	Soil	Ingestion Dermal Inhalation
Site No. 36	Auto Repair Booth Building 1440A	Construction Worker	Soil	Ingestion Dermal Inhalation
Site No. 39	Clear Creek Floodplain	Recreational User (child and adult) Construction Worker	Surface Water	Ingestion Dermal Inhalation
		Recreational User (child and adult) Construction Worker	Sediment	Ingestion Dermal
Site No. 40	Basewide Groundwater	Site Occupational Worker Construction Worker Military Resident (child and adult)	Groundwater (includes leaching from soil to groundwater)	Ingestion Dermal Inhalation

[(a)]This preliminary list of human health receptors will be refined following the human health characterization phase of the work.

TABLE 5-2

PROPOSED HUMAN HEALTH RECEPTORS TO BE EVALUATED FOR FUTURE LAND USE AT SITES 7, 29, 36, 39, AND 40 [a]
RI/FS PHASE II-C WORK PLAN FOR
SITES 7, 29, 26, 39, AND 40
NAS WHITING FIELD
MILTON, FLORIDA

Site	Name	Future Land Use Receptors	Exposure Media	Exposure Routes
Site No. 29 Site No. 7	Auto Hobby Shop *South AVGAS Tank Sludge Disposal Area*	Future Resident (child and adult) Trespasser (older child and adult) Site Occupational Worker Construction Worker	Soil	Ingestion Dermal Inhalation
Site No. 36	Auto Repair Booth Building 1440A	Future Resident (child and adult) Trespasser (older child and adult) Site Occupational Worker Construction Worker	Soil	Ingestion Dermal Inhalation
Site No. 39	Clear Creek Floodplain	Recreational User (child and adult) Construction Worker	Surface Water	Ingestion Dermal Inhalation
		Recreational User (child and adult) Construction Worker	Sediment	Ingestion Dermal
Site No. 40	Basewide Groundwater	Future Resident (adult and child) Site Occupational Worker Construction Worker	Groundwater (includes leaching from soil to groundwater)	Ingestion Dermal Inhalation

[a] This preliminary list of human health receptors will be refined following the human health characterization phase of the work.

therefore, only a construction worker's exposure to soil will be considered for current conditions. For future conditions, it is assumed that the concrete and asphalt will not necessarily remain in place; therefore, additional receptors will be considered for soil exposure at Site 36. An on-site resident will be evaluated under future conditions for comparison purposes, although it is expected that the land will continue to be used as a naval base. Exposure pathways for current and future conditions for Site 40, Basewide Groundwater, will include leaching from soil to groundwater.

The source of contamination or the initial receiving medium is usually the soil. Migration of contaminants from soil occurs through several different mechanisms including leaching to groundwater and water or wind erosion to other media. Mechanisms for migration into air include volatilization (primarily of VOCs) and wind erosion of contaminated soil (all types of contaminants). This process can also lead to relocation of the contaminants to other surface soil. Infiltration can result in migration into subsurface soil and into groundwater. Dissolved analytes (primarily soluble VOCs, SVOCs, and inorganics) are very mobile and may be transported to wells or discharged to surface water.

5.1.3.3 Quantification of Exposures

The next step is to calculate COPC intakes, via each exposure pathway, for each of the potentially exposed populations. An alternative term for intake is dose. Population-related variables are selected that describe the characteristics associated with individual receptors in that population. Intake is dependent upon exposure factors such as contact rate, age, body weight, body surface area, exposure frequency, exposure duration, and averaging time. When possible, exposure factors are selected from the following USEPA guidance documents: *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance "Standard Default Exposure Factors" Interim Final* (USEPA 1991b), *Dermal Exposure Assessment: Principles and Applications* (USEPA 1992c), and the *Exposure Factors Handbook* (USEPA 1997a).

Exposure Point Concentration

Because contaminant concentrations may vary over a site, an EPC is used to express the exposure concentration as a reasonable maximum exposure (RME) for each exposure pathway.

The Shapiro-Wilk W test (Gilbert 1987) is used to evaluate each data set to determine if it fits a normal or lognormal distribution. If neither distribution fit, the maximum concentration is used for the exposure point concentration (EPC). If there are less than 10 samples, the maximum concentration is chosen as the EPC. Otherwise, the normal or lognormal 95 % UCL is calculated for each analyte in each medium using one-half the reporting limit for all nondetects and the average for samples with duplicates. The normal 95% UCL

(UCL-N) is used if the Shapiro-Wilk W test indicated a normal distribution, and the lognormal 95% UCL (UCL-L) is used if the Shapiro-Wilk W test indicated a lognormal distribution. The lesser of the maximum concentration and the appropriate UCL is used for the EPC.

If the Shapiro-Wilk test indicates normally distributed data, the calculation of the UCL-N is a two-step process. First the standard deviation of the sample set must be determined, as follows:

$$S = \left[\frac{\Sigma(X_i - \bar{X})^2}{(n-1)}\right]^{1/2}$$

where:	S	=	standard deviation
	X_i	=	individual sample value
	n	=	number of samples
	$\bar{X}$	=	mean sample value

The one-sided UCL on the mean is then calculated as follows:

$$UCL = \bar{X} + t\left(\frac{S}{n^{1/2}}\right)$$

where:	UCL	=	95 percent Upper confidence limit of the mean
	$\bar{X}$	=	Arithmetic average
	t	=	One-sided t distribution factor ($t_{0.95}$)
	s	=	standard deviation
	n	=	number of samples

If the Shapiro-Wilk test indicates log-normally distributed data sets, the UCL-L is calculated using the following equation:

$$UCL = \exp\left(\bar{X} + 0.5s^2 + \frac{Hs}{(n-1)^{1/2}}\right)$$

where:	UCL	=	95 percent UCL of the mean
	exp	=	Constant (base of the natural log, e)
	$\bar{X}$	=	Mean of the transformed data
	s	=	Standard deviation of the transformed data
	H	=	H-statistic (from Gilbert, 1987; $H_{0.95}$)
	n	=	Number of samples

This equation uses individual sample results that have been transformed by taking the natural logarithm of the results.

Chemical Intake

The general equation for calculating chemical intake from the various media is shown below.

$$Intake(mg / kg - day) = \frac{[CxCRxEFxEDxCF]}{[BWxAT]}$$

where

C	=	EPC of the chemical, medium-specific;
CR	=	contact rate, medium-specific;
EF	=	exposure frequency, population-specific;
ED	=	exposure duration, population-specific;
CF	=	conversion factor, medium-specific;
BW	=	body weight of hypothetically exposed individual; and
AT	=	averaging time (for carcinogens, AT=70 years x 365 days/year; for noncarcinogens, AT=ED x 365 days/year).

The specific equations used to calculate intakes from the different exposure pathways and the values used in the risk calculation spreadsheets for each site will be provided in an appendix to the RI report. Equations and parameters for intake calculations will be presented in formats required by *Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments)* (USEPA 1998a).

Some exposure pathways require additional calculations before intake values can be calculated. The following are brief explanations of the additional calculations required for the inhalation of soil vapors and particulates, inhalation of vapors while showering, and dermal absorption from water.

Inhalation of Soil Vapors and Particulates

The chemical concentration in air from soil vapors and particulates is calculated by the following equation:

$$C_{air} = C_{soil} X (1/PEF + 1/VF)$$

where

C_{air} = chemical concentration in air from soil vapors and particulates

C_{soil} = chemical concentration in soil, chemical-specific

PEF = particulate emission factor

VF = volatilization factor, chemical-specific

For nonvolatile chemicals, the 1/VF term is deleted from the equation.

Inhalation of Vapors while Showering

For this exposure scenario, the contaminant concentrations in air are estimated based on release rates of volatiles from shower water. After reviewing the literature, the model selected to predict indoor (bathroom) concentrations is the Foster and Chrostowski (1987) model.

Dermal Absorption from Water

The dermally absorbed dose (DAD) is calculated in accordance with USEPA's *Dermal Exposure Assessment: Principles and Applications, Interim Report* (1992c). The calculation of the DAD requires the calculation of the absorbed dose per event (DAevent). The permeability constant (K_p) is used to calculate the DAevent. For inorganic compounds, the calculation uses a steady-state approach. For organic compounds, the calculations account for unsteady-state conditions typical of the relatively short exposure associated with bathing. In addition, for organic compounds, the calculations account for the dose that can occur after actual bathing is finished due to absorption of chemicals stored in skin lipids.

For inorganics, K_p is assumed to be equal to that of water and the DAevent is equal to the product of three parameters: K_p, the concentration of the chemical in water (C_w), and the duration of the exposure event (t_{event}). For organic chemicals, the DAevent is calculated from a more complex set of equations, which also use K_p, but involve the calculation of several other intermediate factors. A comparison of t_{event} and one of these factors determine which of two separate equations should be used for DAevent for each organic chemical.

5.1.4 Toxicity Assessment

The toxicity assessment evaluates the evidence available on the potential adverse effects associated with exposure to each analyte. With this information, a relationship between the extent of exposure and the likelihood and severity of adverse human health effects is developed. Two steps are typically associated with toxicity assessment: hazard identification and dose-response assessment.

Hazard identification describes adverse effects that have been associated with exposure to a chemical and, more importantly, whether those effects will occur in humans. Characterizing the nature and strength of causation is also a part of the hazard identification step. The HHRA contains a toxicity profile for each COPC found at each site. The toxicity profile describes the physical and toxicological properties of each contaminant.

A dose-response assessment is conducted to characterize and quantify the relationship between intake, or dose, of a COPC and the likelihood or severity of a toxic effect or response. There are two major types of toxic effects evaluated in this risk assessment: carcinogenic and noncarcinogenic.

Following USEPA guidance (USEPA 1989a), these two endpoints are evaluated separately. USEPA's weight-of-evidence classifications and numerical toxicity factors for carcinogens have been developed and have undergone extensive peer review. Toxicity information used in the toxicity profile is primarily from the USEPA Integrated Risk Information System (IRIS), USEPA Health Effects Assessment Summary Tables (HEAST), Agency for Toxic Substances and Disease Registry (ATSDR) Toxicology Profiles, and the USEPA Environmental Criteria and Assessment Office.

A dose-response assessment will be completed to identify the relevant oral, dermal, and inhalation toxicity values for carcinogenic [cancer slope factors (CSFs)] and noncarcinogenic [reference doses (RfDs)] effects of the COPCs. As required by USEPA Region IV guidance (USEPA 1995a, b), risks associated with soil and water dermal contact will be evaluated using RfDs and CSFs that are specific to absorbed doses. It will, therefore, be necessary to adjust oral toxicity values so that they can be used for evaluation of absorbed doses. When appropriate published data are available on oral absorption of a specific chemical, such as the chemical-specific ATSDR Toxicological Profile, they are used to make the administered/absorbed dose adjustment. In the absence of chemical-specific data, the Region IV Office of Health Assessment (OHA) has adopted the following oral absorption efficiencies as interim default values: 80% for VOCs, 50% for SVOCs, and 20% for inorganic chemicals (USEPA 1995).

5.1.5 Human Health Risk Characterization

Risk characterization involves the integration of the exposure and toxicity assessments into quantitative expressions of potential human health risks associated with COPC exposure. Quantitative estimates of both carcinogenic and noncarcinogenic risks are made for each COPC and each complete exposure pathway identified in the exposure assessment. A clear distinction will be made between risks associated with current and potential future conditions.

Carcinogenic Risks

Carcinogenic risks associated with exposure to individual chemicals will be estimated by multiplying the estimated chemical intake for each carcinogen (in units of mg/kg-day) by its USEPA CSF [in units of $(mg/kg\text{-}day)^{-1}$]. The result is a chemical-specific ELCR. This value represents the probability of developing cancer over the course of a 70-year lifetime as a result of exposure to a chemical. For each exposure pathway, cancer risks associated with multiple carcinogenic compounds are determined by summing the chemical-specific risks to yield a pathway-specific ELCR. For each receptor, cancer risks are summed for all pathways and media. USEPA's guidelines (40 CFR Part 300) state that the total ELCR for an individual resulting from exposure at a hazardous waste site should not exceed a range of 10^{-6} to 10^{-4}. Carcinogenic COPCs that significantly contribute to a pathway in a use scenario for a receptor are considered chemicals of concern (COCs) (USEPA 1995b). In accordance with FDEP (1995), remedial goals will be calculated for any risks greater than 10^{-6}, and risks greater than 10^{-6} for individual compounds in any medium will be identified.

Noncarcinogenic Risks

Noncarcinogenic risk estimates will be determined by dividing estimated chemical intakes (in units of mg/kg-day) by the appropriate RfD (in units of mg/kg-day). The resulting ratio is the HQ. The Hazard Quotient (HQs) for individual COPCs within an exposure pathway are summed, resulting in a hazard index (HI) for that pathway. An HI less than or equal to 1.0 represents concentrations and levels of exposure at which no adverse effects are expected. An HI greater than 1.0 indicates there is a risk of adverse effects and the risk increases as the IH increases. An HI above 1.0 will necessitate additional analyses to determine the likelihood of an adverse effect actually occurring if exposure were to occur. If the HI exceeds 1.0, then more specific HIs should be developed by summing HQs of COPCs with RfDs based on toxic effects on the same target organs. The specific target-organ-based HI should form the basis COC selection (USEPA 1995b). COCs are those chemicals with HQs equal to or greater than 0.1 and which have toxic effects on the same target organs. Remedial goals will be calculated for noncarcinogenic COCs (USEPA 1995b).

Remedial Goal Options

The RGOs for chemicals and media of concern will be developed and will include both ARARs and health-based cleanup goals. The purpose of this information is to provide decision-makers with options upon which to develop the remedial approach.

Consistent with USEPA Region IV guidance (USEPA 1993c), if a given medium has a cumulative cancer risk greater than 10^{-4}, its noncarcinogenic HQ is greater than 1.0, and/or ARARs are exceeded, RGOs will be developed for chemicals in that medium.

In accordance with FDEP (1995), any risks greater than 10^{-6} are worthy of further attention; therefore, risks greater than 10^{-6} for individual chemicals in any medium will also be identified, and RGOs will be developed for those chemicals. Chemicals need not be included if their individual carcinogenic risk contribution to the pathway is less than 10^{-6} or their noncarcinogenic HQ is less than 0.1. If a chemical is detected in groundwater and soil (either surface soil or subsurface soil), then the Florida leachability value will be presented as a separate column in the RGO table.

Media cleanup levels are risk-specific and medium- and exposure-scenario-specific analyte concentrations. They are based on the site-specific exposure parameters (combined ingestion, dermal, and inhalation exposures) and the toxicity information used in the baseline risk assessment.

5.1.6 Uncertainty Analyses

Uncertainties in the quantification of risk associated with the site are identified and their impacts on risk estimates are discussed in a separate section of the HHRA. These uncertainties can arise from several sources. Some common uncertainties include: (1) uncertainties in the analytical procedures to accurately define the contaminant concentrations; (2) uncertainties in obtaining EPCs for use as representative of the exposure concentrations; (3) uncertainties in choosing accurate exposure scenarios and representative exposure factors used to calculate intake; (4) uncertainties associated with the accuracy or absence of toxicity values; and (5) uncertainties associated with the potential for synergistic or antagonistic interaction between COPCs.

The majority of the assumptions made in the risk assessment process are conservative; thus, the estimated risk is probably an overestimate of the actual risk associated with exposure at the site.

The uncertainty section of the HHRA may also include unusual site conditions or extenuating circumstances that may be pertinent to risk management decisions. Other factors such as the inadequacy of toxicity factors to describe all possible COPC–receptor interactions and individual differences within the human population may be included in this section.

5.2 ECOLOGICAL RISK ASSESSMENT METHODOLOGY

In addition to characterizing the nature and extent of site contamination and assessing potential risks to human health, the RI process requires an assessment of the potential adverse effects of site contamination on the environment. Specifically, ecological receptors that inhabit Clear Creek Streambed and the Clear Creek Floodplain may be at risk from environmental contamination associated with NAS Whiting Field. Accordingly, an ecological risk assessment (ERA) will be performed to characterize the potential risks from base-related chemicals to ecological receptors in the Clear Creek area. Section 5.2.1 of this Work Plan provides an overview of the "screening-level" ERA methodology that will be used. Sections 5.2.2 through 5.2.5 describe these methods in detail. Sections 5.2.6 through 5.2.10 present the "baseline" ERA methods. Section 5.2.11 provides a discussion of risk management.

5.2.1 Overview: Screening-Level Ecological Risk Assessment

This section provides an outline of the general screening-level approach that will be taken to assess the impacts of site contamination on ecological receptors. This assessment will generally follow a two-step process:

Step 1: Preliminary Problem Formulation (Section 5.2.2) and Ecological Effects Evaluation (Section 5.2.3)

- Preliminary Problem Formulation - This is the first phase of an ERA, which discusses the goals, breadth, and focus of the assessment. It includes general descriptions of the site to be investigated with emphasis on the habitats and ecological receptors present. This phase also involves characterization of chemical sources and migration pathways, evaluation of routes of chemical exposure, and selection of analytes to be assessed. Assessment and measurement endpoints are also selected in this phase. Finally, a conceptual model is developed that describes how chemicals associated with NAS Whiting Field may come into contact with Clear Creek Streambed and Clear Creek Floodplain ecological receptors.

- Preliminary Ecological Effects Evaluation - In this phase, medium-specific ecological screening guidelines for each analyte (i.e., concentrations of each chemical above which adverse effects to ecological receptors may occur) are identified. Chemical doses associated with toxicity to representative ecological receptors are also identified. This step is undertaken concurrently with the exposure assessment described below.

Step 2: Preliminary Exposure Estimate (Section 5.2.4) and Risk Calculation (Section 5.2.5)

- Preliminary Exposure Estimate - This portion of the ERA includes the identification of data sources containing concentrations of chemicals to which ecological receptors may be exposed in various media. It also includes the selection of exposure point chemical concentrations from those data. Chemical doses for representative receptors are also calculated.

- Preliminary Risk Calculation - In this step, exposure point concentrations are compared to guidelines in order to characterize potential risk to ecological receptors. Chemical doses associated with toxicity are compared to calculated doses for representative receptors. Analytes found to pose potential risk after these comparisons are selected as ecological COPCs.

When these two steps are completed, the results can be interpreted and the uncertainties associated with the ERA can be addressed. The above process, described in further detail below, represents the first two steps in the general 8-step ERA approach recommended in the most recent USEPA guidance for performing ERAs, the "Process Document" (USEPA 1997b), which will serve as the basis for the ERA methodology. Furthermore, the ERA will be conducted in accordance with other available ERA guidance documents (USEPA 1995c; USEPA 1998b; Wentsel et al., 1996). The methods used in this ERA will be based also, in part, on those used in previous ERAs for NAS Whiting Field as presented in the base General Information Report (GIR; ABB-ES, 1998).

Due to the potential complexity of ERAs, they are often conducted using a tiered approach and punctuated with Scientific/Management Decision Points (SMDPs). SMDPs are meetings involving the risk assessors, risk managers, and client to control costs, prevent unnecessary analyses, and ensure that the ERA is proceeding in an efficient, timely manner. Information analyzed in one tier is evaluated to determine whether the objectives of the study have been met, and then it may be used to identify the data required for the next tier, if necessary. This ERA will be considered a "screening-level" assessment since it is based on comparing chemical concentrations against conservative screening values and an evaluation of historical ecological data. Again, it comprises steps 1 and 2 of the Superfund ERA process.

A baseline ERA (BERA), Steps 3 through 7 in the 8-step Superfund ERA process, may be conducted if the results of the screening-level ERA indicate that additional study is warranted. The BERA includes more focused studies that incorporate the initial screening, but it may also encompass detailed laboratory and field studies or extensive modeling (USEPA 1997b). Since the details of Steps 3 through 7 will depend on the results of the first two steps they will not be discussed in detail in this Work Plan. However, the basic elements of these steps are discussed briefly below.

5.2.2 Preliminary Problem Formulation

5.2.2.1 Habitat Types and Ecological Receptors

Preliminary problem formulation begins with a description of the site, its ecological setting (habitat types), and the ecological receptors that are or could be present. A site visit will be conducted by project ecologists to obtain the necessary information for this step. Maps of the habitats will be generated that characterize the habitats present. Plant communities will be identified and classified according to the Florida Natural Areas Inventory (FNAI) habitat classifications (FNAI, 1990). In addition, information regarding rare, threatened, and endangered species will be obtained from base personnel, FNAI, Florida Game and Fresh Water Fish Commission (FGFWFC), and the United States Fish and Wildlife Service (USFWS). Project ecologists will document the presence or absence of these species during the site visit. USFWS National Wetlands Inventory (NWI) maps will be consulted to obtain information regarding wetlands in Clear Creek Streambed and the Clear Creek Floodplain.

5.2.2.2 Major Chemical Sources and Migration Pathways

Most of the base serves as a source of chemicals to Clear Creek. The ERA will investigate and document all possible chemical sources and chemical migration pathways to Clear Creek. A migration pathway is the pathway by which a chemical travels from its source (e.g., drums in soil) to potential receptors (USEPA 1997b). In general, the possible chemical migration pathways include volatilization, wind erosion, overland runoff, infiltration, and groundwater-to-surface water migration of chemicals.

5.2.2.3 Exposure Routes

All relevant chemical exposure routes for all types of receptors identified in the Clear Creek area will be investigated during preliminary problem formulation. An exposure route is a point of contact/entry of a chemical from the environment into an organism (USEPA 1997b).

Exposure to chemicals in the soil via dermal contact may occur, but is unlikely to represent a major exposure pathway because fur, feathers, and chitinous exoskeletons probably minimize transfer of chemicals across dermal tissue. In addition, little information is available (e.g., absorption factors) to evaluate dermal exposures to wildlife. Therefore, the dermal exposure pathway will not be quantitatively assessed.

Volatile constituents may be present in some site soils, soil-bound chemical resuspension may occur, and combustion may release chemicals into the air at some sites. However, inhalation does not represent a significant exposure pathway because air chemical concentrations are assumed to be quite low, even for burrowing wildlife, unless after a large spill of a volatile compound. In addition, inhalation ecotoxicity data for chronic exposure are lacking. Hence, the air pathway will not be quantitatively considered for ecological receptors.

5.2.2.4 Selection of Analytes to be Investigated

Analytes initially included in the ERA for quantitative analysis will be all chemicals detected in surface water, sediment, surface soil, and groundwater samples to be collected for this study. Calcium, magnesium, potassium, and sodium will be excluded as analytes to be investigated since they are essential nutrients that are toxic only in extremely high concentrations. Due to the scarcity of data for these essential nutrients, it is not possible to develop ranges of toxicity for them, even at high concentrations. The limited toxicity data available indicate that high dietary intake of these nutrients is well tolerated. The process that will be used to select COPCs from the detected analytes is described in Section 5.2.5.

As described in the base GIR (ABB-ES 1997), inorganics in site media that are detected at maximum concentrations less than two times the average background concentrations are generally excluded from further consideration. This has historically been performed as per Region 4 USEPA preference since inorganics are naturally occurring chemicals that can be found in locally high concentrations regardless of anthropogenic influences. However, Region 4 has indicated that use of background or upgradient data for comparisons to site data should at present be investigated in Step 3 of the 8-step ERA process.

5.2.2.5 Assessment and Measurement Endpoints

As discussed in USEPA (1997b) and Wentsel et al. (1996), one of the major tasks in preliminary problem formulation is the selection of assessment and measurement endpoints. An assessment endpoint is defined as "an explicit expression of actual environmental values that are to be protected" (USEPA 1997b). Measurement endpoints are "measurable ecological characteristics that are related to the valued characteristic chosen as the assessment endpoint" (USEPA 1997b). Assessment endpoints reflect the resources that are to be protected and, thus, are the underpinning of the entire ERA. The remainder of the ERA will directly and indirectly focus and support the assessment endpoints. Hence, the selection of appropriate assessment endpoints is a crucial step in the ERA process. For this ERA, the assessment endpoints will be protection of one or more of the following groups of receptors from adverse effects of chemicals on their growth, survival, and reproduction:

- benthic invertebrate communities
- birds that feed on terrestrial invertebrates and plants
- carnivorous birds
- carnivorous mammals
- omnivorous mammals
- mammals that feed on soil invertebrates
- herbivorous mammals
- aquatic/terrestrial vegetation
- terrestrial invertebrates
- fish communities

- birds that feed on aquatic organisms
- amphibians and reptiles

The site visit and other relevant information will be used to determine which assessment endpoints are appropriate for inclusion into the Clear Creek ERA. As indicated above, measurement endpoints are related to assessment endpoints, but these endpoints are more easily quantified or observed. In essence, measurement endpoints, also known as measures of effects (USEPA 1998b) serve as surrogates for assessment endpoints. While declines in populations and shifts in community structure can be quantified, studies of this nature are generally time-consuming and difficult to interpret. However, measurement endpoints indicative of observed adverse effects on individuals are relatively easy to measure in toxicity studies and can be related to the assessment endpoint. For example, chemical concentrations that lead to decreased reproductive success or increased mortality of individuals in toxicity tests could, if found in the environment, result in shifts in population structure, potentially altering the communities on and near Clear Creek.

For surface water, the measurement endpoints will be chemical concentrations in surface water associated with adverse effects on growth, survival, and reproduction of aquatic organisms (surface water screening levels). For sediments, the measurement endpoints will be chemical concentrations in sediment associated with adverse effects on growth, survival, and reproduction of benthic organisms (sediment screening levels). For surface soils, the measurement endpoints will be chemical concentrations in surface soil associated with adverse effects on growth, survival, and reproduction of terrestrial vegetation and soil invertebrates (surface soil screening levels). For terrestrial and semi-aquatic wildlife, the measurement endpoints will be the chemical doses associated with adverse effects on growth, survival, and reproduction of these receptors (toxicity reference values). The measurement endpoints listed above will reflect, to the fullest extent possible, the groups of receptors that will be listed in the assessment endpoints.

5.2.2.6 Preliminary Conceptual Site Model

The conceptual model is designed to diagrammatically identify potentially exposed receptor populations and applicable exposure pathways, based on the physical nature of the site and the potential chemical source areas. Actual or potential exposures of ecological receptors associated with the sites assessed in this ERA will be determined by identifying the most likely pathways of chemical release and transport. A complete exposure pathway has three components: a source of chemicals that can be released to the environment; a route of chemical transport through an environmental medium; and an exposure route or contact point for an ecological receptor. A preliminary conceptual model for Clear Creek Streambedand the Clear Creek Floodplain will be included in the screening-level ERA. The dermal route (direct contact) and inhalation exposure routes will be included in the conceptual model since they are theoretically possible, but as mentioned earlier, they will not be quantitatively investigated.

5.2.3 Preliminary Ecological Effects Evaluation

For this ERA, exposure point concentrations of detected analytes in surface water, groundwater, sediment, and surface soil will compared to ecologically-based guidelines to determine if they should be selected as COPCs. In addition, toxic doses of chemicals will be compared to modeled doses for representative receptors. The methods used for screening level selection and toxicity reference value (TRV) selection are discussed in detail below.

5.2.3.1 Region 4 Screening Levels

The first step in the Region 4 ERA process is comparison of maximum concentrations of detected chemicals to ecological screening levels. Region 4 screening levels will be used for this ERA (USEPA 1995c). Chemicals whose maximum concentrations do not exceed Region 4 screening levels will be dropped from further consideration, while those that equal or exceed Region 4 screening levels will be considered further. For surface water, Region 4 screening levels are primarily chronic ambient water quality criteria (AWQCs). Since Clear Creek is located in an inland area, Region 4 freshwater values will be used. Region 4 sediment screening levels are primarily based on Florida Department of Environmental Protection (FDEP) threshold effects levels (TELs) and National Oceanographic and Atmospheric Administration (NOAA) Effects Range-Low (ER-L) values.

Region 4 USEPA has not promulgated its own surface soil guidelines. Work has been initiated by an USEPA task group, and it is anticipated that soil screening values will be issued sometime in 1999. In the recent past Region 4 has recommended soil guidelines from a 1990 USFWS document (Beyer, 1990) for use in the ecological screening value comparison. These values are commonly known as the "Dutch" soil guidelines. Beyer (1990) presents "A," "B," and "C" Dutch values, which represent background concentrations or detection limits, moderate soil contamination that may require additional study, and contamination that should be considered for immediate cleanup, respectively. Region 4 recommended the use of A values as soil screening levels.

The Dutch values from Beyer (1990) were superceded by new Dutch values promulgated in 1994 (MHSP&E, 1994). The 1994 values are referred to as "Target Values" and "Intervention Values." Target Values represent the "soil quality required for the full restoration of the soil's functionality for human, animal and plant life" or "soil quality ultimately aimed for." The Intervention Values replace the 1990 C values and represent "the concentration levels of the chemicals in the soil...above which the functionality of the soil for human, plant, and animal life is seriously impaired or threatened." The Dutch B values were discontinued in the Dutch (MHSP&E, 1994) document. Similar values can be calculated using methods described in the 1994 Dutch document that take into account site-specific parameters (e.g., soil organic carbon) but will be beyond the scope of this ERA. The 1994 intervention values also take into account ecotoxicological considerations.

Region 4 (Wellman, 1999) now recommends the use of surface soil screening levels as compiled by Friday (1998). These consist of values issued by Beyer (1990), Oak Ridge National Laboratory (Efroymson et al., 1997 a,b), the Netherlands (MHSP&E, 1994), Crommentuijn et al.(1997), and the Council of Canadian Ministers of the Environment (CCME, 1997). Recommended screening levels are generally the lowest value from among the above sources.

According to conversations with Region 4 USEPA, the screening level for benzo(a)pyrene will be used as a surrogate for high molecular weight polyaromatic hydrocarbons (PAHs) when screening levels are not available for those compounds, and the screening level for diethylhexylphthalate (DEHP) will be used when screening levels are not available for some phthalates. Moreover, when screening levels are available for different species of the same inorganic, the screening level for the most toxic form will be used, including those for hexavalent chromium, trivalent arsenic, methyl mercury, and tributyl-tin. The exception will be if speciated chemical data are available.

5.2.3.2 Toxicity Reference Values (TRVs)

Modeling of chemical exposure via the foodchain will be performed to investigate potential risks to terrestrial and semi-aquatic wildlife. TRVs for individual receptors will be obtained for comparison to estimated doses that the receptors may receive in the environment. TRVs will be preferentially identified that represent a threshold for sub-lethal effects. Sub-lethal effects are defined as those based on the measurement endpoint, which is impairment of reproduction, growth, or long-term survival. Separate TRVs will be obtained for mammals and birds, as discussed below.

Since toxicity data for the specific receptors chosen are not often available, toxicity data from laboratory species will be extrapolated to receptor species. Most of the toxicity data will be obtained from ORNL wildlife toxicity data (Sample et al., 1996). Other sources of toxicity data will be used, which include the Integrated Risk Information System (IRIS) and the ATSDR toxicity profiles. No-observed-adverse-effects-levels (NOAELs) and lowest-observed-adverse-effects-levels (LOAELs) will be used in the models. As specified in USEPA Region 4 guidance, LOAELs will be divided by a factor of 10 to obtain NOAELs if

NOAELs are not available for a chemical. Following discussions with Region 4 USEPA, VOCs were not included in foodchain modeling. Analytes with log K_{ow} values less than 3.5 (VOCs) generally do not accumulate in animal tissue (Suter, 1993).

Species used in the foodchain modeling will be chosen to represent the groups of receptors most likely to be exposed to the highest chemical concentrations because of their position in the food web, diet (ingestion rate and food type), home range (contained within the area of contamination), and body size. The species selected will be assumed to be representative of other species within the same trophic group or guild. For each of the representative species, information on life history will be obtained and discussed including diet, average body weight, food ingestion rate, home range, and exposure duration (percent of total time that a receptor may reside at the site). Initially, however, the area use factor and exposure duration will conservatively assumed to be 100 percent. The receptors will be selected to represent the groups of organisms specified in the assessment endpoints.

Amphibians and reptiles will not used as representative receptors in this ERA since toxicity data are lacking (only a few suitable NOAELs are available), resulting in a small, sporadic toxicity database. Hence, the potential risks to reptiles and amphibians from most chemicals cannot be adequately assessed via the foodchain modeling and, therefore, their inclusion in the modeling adds little value to the assessment. A discussion of the uncertainties associated with the absence of toxicity data for this group of receptors will be provided in the ERA. Also, data for toxic doses are scarce for fish species, such as the largemouth bass (*Micropterus salmoides*) (large aquatic predator). The surface water screening levels to be used in this ERA are based, in part, on toxicity to sensitive fish species (e.g., salmonids).

5.2.4 Preliminary Exposure Estimate

5.2.4.1 Exposure Point Concentrations

Data used to obtain exposure point chemical concentrations in this ERA will be those obtained from proposed sampling for Clear Creek Streambed and the Clear Creek Floodplain. The maximum detected concentrations of chemicals in surface water, sediment, and surface soil will be used as exposure point concentrations and will be compared to ecological screening levels in the risk calculation step. The maximum detected concentrations in groundwater will be used as exposure point chemicals in that medium, if applicable. Aquatic and semi-aquatic organisms will not be directly exposed to groundwater chemicals but could be exposed via groundwater discharge to Clear Creek and surrounding areas. Comparing groundwater concentrations to Region 4 surface water screening levels is a very conservative measure of potential impacts to aquatic media from contaminated groundwater discharge. It does not take into account dilution at the discharge point(s), which would probably be substantial; the amount of discharge; location of the point(s) of discharge; direction of groundwater flow; or bioavailability of groundwater chemicals. Since groundwater under most of the base flows towards Clear Creek, groundwater-to-surface water migration of chemicals may be an important issue in this ERA.

5.2.4.2 Chemical Doses for Representative Receptors

A simple model will be used to predict dietary exposures for representative receptor species to be compared to TRVs in the risk calculation step. The actual dose a receptor species receives as the result of indirect or direct exposure is dependent upon the habits of the species and other factors. The equations used to calculate the dose of chemicals ingested for each exposure route for the representative receptors that will be used in this ERA are presented below.

Both the maximum and average detected concentrations of chemicals will be used in the model. Average concentrations will be used to provide balance in the ERA.

Incidental Ingestion of Soil

Daily intake of each chemical as a result of ingestion of soil will be determined using the following equation, which will also be used for ingestion drinking of surface water and incidental ingestion of sediment:

$$\text{PD ingestion of soil} = (C_{soil} * FI * F)/(WR)$$

where:	PD	=	predicted dose from ingestion of soil (mg/kg/day)
	C_{soil}	=	concentration in soil (mg/kg)
	FI	=	fractional intake (% of home range that overlaps impacted area assumed to be 100%)
	F	=	soil consumed (kg/day)
	WR	=	body weight (kg)

Ingestion of Food items

The following equation will be used to estimate chemical intake from ingestion of contaminated food items:

$$\text{PD ingestion of food} = (C_{food} * F * FA * FI)/(WR)$$

where: PD = predicted dose from ingestion of food items (mg/kg/day)
C_{food} = chemical concentration (vegetation or prey; mg/kg)
F = food consumed (kg/day)
FI = fractional intake (% of home range that overlaps affected area assumed to be 1
FA = percent of diet that equals animals and/or vegetation
WR = weight of receptor (kg)

Preferentially the input parameters (e.g., body weight, ingestion rate) for the representative receptors will be obtained from USEPA's *Wildlife Exposure Factors Handbook: Volumes I and II* (1993d). In general, the values used for the input parameters will be conservative (e.g., lowest body weight) presented in the USEPA publication. It should also be noted that the exposure parameters for the receptors will be those previously used in other ERAs for NAS Whiting Field, when possible.

For simplicity in the screening-level ERA, bioaccumulation factors (BAFs) may be set equal to 1.0; USEPA Environmental Response Team (ERT) currently recommends this approach. Region 4 (Wellman, 1999) has indicated that this approach is acceptable at Federal Facility sites where a multitude of chemicals are expected to be present. In this instance, the potential over- or underestimation of potential risks from certain classes of chemicals will be discussed in the uncertainties. If Region 4 requires that BAFs be used they will be obtained from commonly cited sources and from previous ERAs performed at NAS Whiting Field.

5.2.5 Risk Calculation

As identified by USEPA (1997b), the preliminary risk calculation step in the ERA process compares chemical doses for representative receptors to doses associated with toxic effects. Prior to that step, the maximum concentrations of chemicals in each medium are compared to Region 4 screening levels. The ratio of the exposure point chemical concentration to the screening level or the estimated dose to the toxic dose is called the hazard quotient (HQ), and is defined as follows:

$$HQ_i = EPC_i/ESG_i \quad \text{or} \quad HQ_i = ID_i/TRV_i$$

where: HQ_i = Hazard Quotient for analyte "i" (unitless)
ID_i = Intake Dose for analyte "i" (mg/kg/day)
EPC_i = Exposure Point Concentration for analyte "i" (ug/L or ug/kg or mg/kg)
TRV_i = Toxicity Reference Value for analyte "i" (mg/kg/day)
ESG_i = Ecological Screening Guideline for analyte "i" (ug/L or ug/kg or mg/kg)

When the ratio of the exposure point concentration to its respective guideline exceeds 1.0, adverse impacts will be considered possible, and the chemical will be selected as a COPC. The HQ value should not be construed as being probabilistic; rather, it is a numerical indicator of the extent to which an exposure point concentration exceeds, or is less than a guideline. When HQ values exceed 1.0, it is an indication that ecological receptors are potentially at risk. Additional evaluation or data may be necessary to confirm with greater certainty whether ecological receptors are actually at risk, especially since most guidelines are conservatively derived (see Section 5.2.6).

The use of HQs is probably the most common method used for risk characterization in ERAs. Advantages of this method, according to Barnthouse et al. (1986), include the following:

- The HQ method is relatively easy to use, is generally accepted, and can be applied to any data.

- The method is useful when a large number of chemicals must be screened.

This method of risk characterization has some inherent limitations. One primary limitation is that it is a "no/maybe" method for relating toxicity to exposure. That is, it uses single values for exposure concentrations and guidelines. The HQ method does not account for the variability in both these parameters, nor for incremental or cumulative toxicity. To loosely address cumulative toxicity, HQs from comparisons to Region 4 screening levels may summed to obtain a HI when chemicals are determined to have similar modes of action, as recommended by USEPA Region 4. This will be done primarily for organochlorine pesticides and PAHs.

The comparisons described above will be presented in screening tables to select COPCs. Screening tables will include the frequency of detection for each analyte, the background concentration, the minimum and maximum detected concentrations, and the chemical-specific Region 4 screening levels. Using maximum chemical concentrations, tables will also generated that present the HQ values for each representative receptor used in the foodchain modeling. Separate screening tables will be provided for maximum and average concentrations. As a result, two sets of COPCs will be generated for the foodchain modeling: maximum concentration COPCs and average concentration COPCs.

In summary, the COPC selection process is as follows:

1. The maximum concentrations of detected chemicals in Clear Creek area surface water, groundwater, sediment, and surface soil will be compared to Region 4 screening levels, with the exception of the

essential nutrients mentioned earlier. If the maximum concentration is less than the Region 4 screening level, it will be dropped from further consideration; if it equals or exceeds the Region 4 screening level, it will be selected as a COPC. If no Region 4 screening level is available the analyte will be selected as a COPC, as per USEPA guidance (1997b).

2. All COPCs will be used in the foodchain modeling.
3. The maximum and average concentrations of COPCs will be used in the foodchain modeling. Hence, a list of maximum concentration COPCs and a list of average concentration COPCs will be generated.

Since no direct exposure is associated with groundwater, COPCs will not selected for this medium. Nevertheless, groundwater analytes with HQs greater than 1.0 will be presented and discussed, as will be groundwater analytes for which no Region 4 screening levels were available.

An SMDP will be conducted after Step 2 to determine if the process should continue into Step 3.

5.2.6 Step 3: Baseline ERA Problem Formulation

The use of conservative guidelines and maximum detected concentrations as a starting point for assessing risks in the screening-level assessment is necessary to ensure that potential risks are not underestimated. However, the use of only a comparison of conservative guidelines to maximum detected concentrations as a tool for determining the need for, nature and magnitude of additional ecological work, and/or a complex baseline ERA has severe limitations.

The undertaking of costly additional ecological analyses must be weighed against benefits, especially in such cases where remedial alternatives are limited or do not exist. Moreover, the environment may suffer as sites of lesser ecological significance are given the same priority as sites of clearly greater ecological concern. For these reasons, the consideration of other relevant factors should be employed after the screening-level assessment, primarily to refine the list of COPCs. Region 4 has historically included these factors as part of the screening-level assessment (at the end of Step 2). Region 4 now considers these factors as part of Step 3 of the 8-step process as they relate to elimination of COPCs. These factors are also part of Step 8 (Section 5.2.11), especially as they relate to ultimate risk management decisions for a site.

5.2.6.1 Refinement of Preliminary COPCs

Several less conservative factors to be considered that are outside the boundaries of simple concentration/guideline comparisons have already been presented. These include the use of average chemical concentrations and LOAELs in the foodchain modeling.

The frequency of detection and spatial analysis of exceedances should be evaluated for all COPCs. Evaluation of these items allows for determination of whether potential risks are widespread or limited to a small area. The magnitude of the HQs should also be evaluated. As described earlier, the relationship between the magnitude of an HQ and toxicity is not necessarily linear. However, the magnitude of an HQ can be used as rough approximation of the extent of potential risks, especially if there is sufficient confidence in the guideline used. Region 4 guidelines are designed to be conservative. Therefore, less conservative guidelines will be presented for sediment and surface soils when chemical concentrations exceed Region 4 screening levels. ORNL (Sample et al., 1998) suggest the presentation of all available screening levels in the ERA to help determine potential risks using the "weight-of-evidence."

The use of less conservative guidelines provides balance to the conservative screening-level assessment. For example, some Region 4 sediment guidelines are based on ER-L guidelines obtained from Long et al. (1995). However, an ER-L is defined as the concentration below which adverse ecological "effects would rarely be observed" (Long et al., 1995). The ER-M is the point below which adverse effects "would occasionally occur" (Long et al., 1995). Therefore, ascribing risk to a sediment chemical detected in a concentration that exceeds the ER-L, but is below the ER-M, can be misleading. Hence, when chemical concentrations exceed Region 4 screening levels, or no Region 4 screening level is available, less conservative guidelines, such as ER-Ms, will be presented as part of Step 3 in tables containing all of the sediment and surface soil COPCs. The tables will also present the average concentration of the COPCs. Stakeholders can use this information to decide if chemicals should be dropped from further consideration.

Sediment severe effects levels (SELs), ER-Ms, and FDEP probable effects levels (PELs) may be presented for comparison. SELs, as presented in Jones et al. (1996), are from the Ontario Ministry of the Environment (MOE). MOE guidelines are based exclusively on observed effects in the field (absence of certain species). The SEL represents the chemical level that could potentially eliminate most of the benthic organisms. Unlike NOAA and FDEP guidelines, MOE guidelines are based exclusively on freshwater sediments. Hence, they may be more appropriate for this assessment. Environment Canada PELs may also be provided. These guidelines were derived using the same methodology as the NOAA guidelines, but with a slightly different data set.

For surface soils, Dutch B and C values from Beyer (1990) may be considered, as well as surface soil guidelines from ORNL indicative of toxicity to soil invertebrates and terrestrial plants (Efroymson et al., 1997a, b). In addition, Dutch (MHSP&E, 1994) Intervention values may be considered, which superceded the Dutch values presented in Beyer (1990). Additionally, Canadian Council of Ministers of the Environment (CCME) guidelines may be considered.

Because few sources of guidelines other than AWQCs are available for surface water, other guidelines will not be presented for that medium, with the possible exception of Florida State Water Quality Standards for Class III surface water (FAC 62-302). Since the groundwater screening is a rough estimation of potential surface water and sediment potential risks from groundwater discharge, other groundwater guidelines will not be presented. Furthermore, toxicity data and information from various sources in the literature may be discussed as they relate to the interpretation of potential risks from each COPC. These sources include the USFWS Chemical Hazard Reviews, commonly referred to as the "Eisler" publications, and ecotoxicological journals.

Re-evaluation of the conservative parameters used in the foodchain modeling will be performed. Literature-based home ranges for representative receptors may be used, as well as less conservative (more realistic) intake rates. If the HQs drop near or below unity for some chemicals, then the stakeholders should discuss eliminating these chemicals from further consideration. Background data will be presented for inorganic COPCs. COPCs with maximum concentrations comparable to or below background may be dropped from further consideration.

The weight-of-evidence approach (USEPA 1997b) will be used to determine the extent of potential risks when HQ values exceed 1.0. However, analytes will be automatically selected as COPCs if their maximum concentration HQ exceeds 1.0 after screening against Region 4 guidelines.

5.2.6.2 BERA Problem Formulation Issues

If the ERA process continues for some or all COPCs then additional factors are considered in Step 3. Issues addressed in the screening-level ERA are refined and reassessed. Further information regarding fate and transport of COPCs will be obtained, the ecosystems potentially at risk will be evaluated in more detail, and COPC exposure routes will be re-evaluated. This information will allow for further refinement of the assessment endpoints and conceptual model. Finally, risk questions and risk hypotheses for the BERA will be developed as they relate to the assessment endpoints. An SMDP occurs following Step 3 that allows all stakeholders to determine if a BERA should be conducted and, if so, what data should be collected.

5.2.7 Step 4: Study Design and Data Quality Objectives

The purpose of the study design is to prove or refute the hypotheses in the ERA conceptual model developed in Step 3 and produce a BERA Work Plan and Sampling and Analysis Plan (SAP). The study design should provide all procedures used for sampling and all methods, models, or techniques used for data analysis. The relation of the measurement endpoints to these procedures and the specific COPCs will also be specified.

5.2.7.1 Measurement Endpoints

Measurement endpoint selection is an important part of this step (Step 4); again, these endpoints are measurable characteristics related to environmental values to be protected (assessment endpoints). They should serve to help answer the risk questions and hypotheses from Step 3. Examples of measurement endpoints follow, which are more focused than the broad endpoints of the screening-level assessment.

- Endpoints for predictive assessments based on environmental chemical concentrations or doses.
  - Concentrations or doses associated with reproductive or developmental effects in published toxicological studies.
  - Concentrations or doses associated with any effect impacting population fitness.
- Endpoints for toxicity testing.
  - Survival
  - Growth
  - Fecundity of test organisms
- Endpoints for field studies.
  - Population size
  - Population recruitment
  - Community taxonomic diversity
  - Community standing crop or density
  - Community functional group composition

5.2.7.2 Study Design

In general, the BERA study design will be centered around additional field work. Field work for the assessment may include additional sampling of environmental media, biological tissue sampling, and population/community studies. The uses of these types of data are presented below.

Additional sampling of surface water, sediment, surface soil, or groundwater may be required to:

- Verify actual concentrations.
- Obtain data for areas not yet sampled.
- Establish temporal trends.
- Provide information needed in transport models.
- Evaluate bioavailability.

For example, sampling of surface water may be needed to verify concentrations in an area downgradient of groundwater that exceeded water quality criteria. It may be useful to establish temporal trends for organic compounds that are mobile or subject to degradation. Also, sampling may be necessary to supply data on porosity, pH, bulk density, and other measures that are needed for selected transport models.

Tissue sampling for chemicals known to bioconcentrate or bioaccumulate may be necessary to estimate exposure for herbivores or predators, especially for mammalian and avian receptors. This approach is more accurate than estimating uptake from foodchain models that use contaminant concentrations in soil, sediment, or water as inputs. In complex investigations where use of such models is necessary, tissue sampling may be used to validate these models in addition to providing direct exposure data.

Population or community studies are used to evaluate whether effects due to site contaminants are apparent in the field. Typically, measurements are taken at potentially impacted locations and at background or reference areas. The reference areas are selected carefully to be free of site contaminants or other unusual man-induced influences. If statistical comparison of reference to site areas is important, standard techniques are used for establishing the number of samples to be collected from each area, to minimize occurrences of both false positive and false negative errors.

Community studies may be performed to assess potential impacts at the community level. In addition to potential impacts, these studies provide information on the types and abundance of organisms present. A combination of community assessment, toxicity testing, and/or tissue sampling is an efficient design likely to produce useful and conclusive data. In general, co-located samples collected for chemical and biological analysis will be obtained.

Toxicity testing is usually performed to determine if soil, water, or sediment samples are toxic to test organisms; toxicity testing may also be performed using enclosures in the field. As a direct measurement of toxicity, it can remove uncertainty associated with screening values or predictive risk evaluation. Results of toxicity testing are usually less ambiguous than the results of population or community analysis, but are not necessarily predictive of community-level effects. Standardized toxicity tests are available for acute effects, and some tests are designed to estimate chronic effects.

5.2.7.3 Project Data Quality Objectives

Project DQOs are also determined as part of Step 4. The goal of DQOs is to clarify the study objectives and define the most appropriate types of data to collect; determine the most appropriate field conditions under which to collect site data; and specify acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to support risk management decisions.

In summary, the BERA Work plan should include an overview of the study site; a summary of previous analyses and conclusions; a refined conceptual model, which includes identification of potential exposure routes; assessment and measurement endpoints and their relationship to risk hypotheses; identification of the investigations to be conducted; and a description of the assumptions and major sources of uncertainty in the conceptual model and existing information (USEPA 1997b). The SAP will consist of a quality assurance project plan (QAPP) and a field-sampling plan (FSP). The QAPP provides a description of the steps required to achieve the objectives dictated by the intended use of the data. The FSP should include the sampling type and objectives; sampling location, timing, and frequency; sample designation(s); sampling equipment and procedures; and sample handling and analysis (USEPA 1997b).

The completion of the BERA WP and SAP should coincide with an SMDP. Stakeholders should agree on the measurement endpoints, site investigation methods, and selection of data reduction and interpretation techniques. The WP and SAP will also specify how inferences will be drawn from the measurement to the assessment endpoints.

5.2.8 Step 5: Field Verification of Sampling Design

Step 5 in the ERA process is a site assessment to confirm that the ecological SAP is based on accurate observations. If problems with the WP or the SAP are apparent from the site assessment, then changes to these documents will be proposed. For this step the SMDP is approval of the project-specific SAP, with any appropriate changes.

5.2.9 Step 6: Site Investigation and Analysis Phase

Part of Step 6 is the site field investigation, in which the field work specified in the WP and the SAP is carried out. Any field modifications to the BERA Work Plan based on changing field conditions should be communicated to all stakeholders. If the nature and extent of contamination is revealed to be different than expected (e.g., further downstream of a site), the stakeholders will discuss whether additional sampling is needed. At the completion of fieldwork the process of analysis begins; there is no decision point immediately after the field investigation step, unless alterations to the WP and SAP are required (USEPA 1997b). The analysis phase consists of analysis of ecological exposures and effects from the data collected during Steps 1 through 6. The result of the exposure analysis is an exposure profile that quantifies the magnitude and spatial and temporal patterns of exposure as they relate to the assessment endpoints and risk questions developed during problem formulation (USEPA 1997b). Ecological effects are characterized by an exposure-response analysis, which describes the relationship between the magnitude, frequency, or duration of a chemical stressor in an experimental or observational setting and the magnitude of response. These analyses are used to establish evidence of causality. That is, "does a COPC or COPCs appear to be responsible for observed effects?" All supporting evidence should be used when determining evidence of causality.

5.2.10 Step 7: Risk Characterization

Risk characterization is the seventh step in the eight-step ERA process and final phase of the risk assessment, in which the results of the field assessment are reviewed, combined with data collected earlier, and analyzed. It consists of risk estimation and risk description. There are potentially four approaches used in risk estimation: effects predicted by exposure modeling (including measured contaminant concentrations in tissue) as compared to toxicological data, effects inferred from population/community studies, effects observed in toxicity testing, and chemical data. A risk characterization is developed for each approach, and conclusions are drawn after consideration of each characterization.

Reaching conclusions may be difficult because results from different approaches may be contradictory. If so, a weight-of-evidence approach is used to assess ecological impacts (USEPA 1997b), where the assignment of weight to a particular result is based on the reliability of the data. Reliability is a function of combined measurement error, applicability to the receptors of concern, the degree of realism in modeling, and the confidence and power levels associated with statistical testing.

Risk description is used to document the chemical concentrations that bound the threshold for adverse effects on the assessment endpoints (USEPA 1997b). It can also be used to help the stakeholders judge the ecological significance of the estimated risks. Using all available information an upper- and lower-bound of the threshold for effects should be developed. These can be used to determine the likelihood of potential risks. The risk assessor should also put the estimated risks in context with regard to their extent, magnitude, and ecological significance.

Uncertainty analysis is an important part of risk characterization. Due to the number of potential receptor species and frequent lack of knowledge regarding their life histories, feeding habits, toxicological sensitivities, interactions with other species, and responses to natural environmental changes, the uncertainties surrounding estimates of ecological risk are substantial. Thus, the interpretation of toxicity quotients greater than 1, positive results from toxicity testing, or negative results from community comparisons are not necessarily straightforward.

Added to the foregoing sources of uncertainty are those that are common to both human and ecological predictive risk assessments. These include lack of toxicological data, error in analytical data, the COPC identification process, computation of exposure point concentrations, using conservative fate and transport assumptions, and selection of exposure pathways. These uncertainties can be categorized as conceptual model uncertainties, natural variation and parameter error, and model error (USEPA 1997b). These sources of uncertainty and their anticipated effect on estimated risks will be discussed in the risk characterization section of the assessment.

The risk characterization is completed with the production of the ecological risk assessment portion of an RI or RFI report. Decisions regarding future actions take place in the risk management step.

5.2.11 Step 8: Risk Management

Risk management is the eighth and final step in the ERA process. In this step the stakeholders discuss the advisability of no action, remediation, monitoring, or other activities. It should be noted that, as discussed earlier, risk management may have already been employed after the screening-level assessment (in Step 3), if warranted.

The National Contingency Plan (40 CFR 300.430(f)(1)(i)) specifies nine criteria to be evaluated as part of the analysis of remedial actions (USEPA 1997b), as listed below. The first two are threshold criteria.

1. Overall protection of human health and the environment.
2. Compliance with ARARs.
3. Long-term effectiveness and permanence.
4. Reduction of toxicity, mobility, or volume of hazardous wastes through the use of treatment.
5. Short-term effectiveness.

6. Implementability.
7. Cost.
8. State acceptance.
9. Community acceptance.

The final SMDP is the Record of Decision (ROD), which will be based on the criteria listed above. The decision should minimize the risk of long-term impacts that could result from the remedy and any residual contamination (USEPA 1997b).

6.0 INVESTIGATION-DERIVED WASTE MANAGEMENT

IDW generated during RI/FS investigation activities will be managed in accordance with the procedures described in the NAS Whiting Field *Revised Investigation-Derived Waste Management Plan* (ABB-ES 1996a). This document, which is included as Appendix D of this Work Plan, emphasizes management of all IDW in an environmentally responsible manner consistent with the CERCLA program, Resource Conservation and Recovery Act (RCRA) requirements, and the base's standard procedures. The objectives of the IDW management plan are

- Management of IDW in a manner that prevents contamination of uncontaminated areas (by IDW) and that is protective of human health and the environment.
- Minimization of IDW, thereby reducing costs and the potential for human or ecological exposure to contaminated materials.
- Compliance with federal and state requirements that are ARARs.

7.0 SITE ASSESSMENT & REMEDIAL INVESTIGATION REPORT

The draft report will be prepared in accordance with the guidance contained in *Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA 1988a). The report will include appropriate sections concerning site background, investigation activities, physical characteristics, nature and extent of contamination, aquifer characterization, fate and transport, and risk evaluations (both human health and ecological assessments). Numerical modeling may be used to evaluate the nature and extent as well as the fate and transport of contaminants detected at Sites 7, 29, 36, 38, 39, 40, and PSC 1485C. Probable conditions and reasonable deviations, as depicted in the current CSM, will be verified and/or revised and presented in the report. The suggested report format is presented in Table 7-1.

After internal review the draft report will be issued to the NAS Whiting Field Partnering Team for review. The final report will be issued upon incorporation of review comments.

TABLE 7-1

**SITE ASSESSMENT & REMEDIAL INVESTIGATION REPORT FORMAT
WORK PLAN FOR SITES 5, 7, 29, 35, 38, 39, 40, AND PSC1485C
NAS WHITING FIELD
MILTON, FLORIDA
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Executive Summary

1.0 Introduction
- 1.1 Purpose of Report
- 1.2 Site Physical Description
  - 1.2.1 Site Description
  - 1.2.2 Site History
  - 1.23 Previous Investigations
- 1.3 Report Organization

2.0 Study Area Investigation
- 2.1 Includes field activities associated with site characterization. These may include physical and chemical monitoring of some, but not necessarily all, of the following.
  - 2.1.1 Surface Features (topographic mapping, etc.) natural and manmade features
  - 2.1.2 Contaminant Source Investigations
  - 2.1.3 Meteorological Investigations
  - 2.1.4 Surface Water and Sediment Investigations
  - 2.1.5 Geological Investigations
  - 2.1.6 Soil and Vadose Zone Investigations
  - 2.1.7 Groundwater Investigations
  - 2.1.8 Human Population Surveys
  - 2.1.9 Ecological Investigations
- 2.2 If technical memoranda documenting field activities were prepared, they may be included in an appendix and summarized in this report chapter.

3.0 Physical Characteristics of the Study Area
- 3.1 Includes results of field activities to determine physical characteristics. These may include some, but not necessarily all, of the following.
  - 3.1.1 Surface Features
  - 3.1.2 Meteorology
  - 3.1.3 Surface Water Hydrology
  - 3.1.4 Geology
  - 3.1.5 Soils
  - 3.1.6 Hydrogeology
  - 3.1.7 Demography and Land Use
  - 3.1.8 Ecology

TABLE 7-1

SITE ASSESSMENT & REMEDIAL INVESTIGATION REPORT FORMAT
WORK PLAN FOR SITES 5, 7, 29, 35, 38, 39, 40, AND PSC1485C
NAS WHITING FIELD
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4.0 Nature and Extent of Contamination
- 4.1 Presents results of site characterization, both natural chemical components and contaminants, in some, but not necessarily all, of the following media.
  - 4.1.1 Sources (lagoons, sludges, tanks, etc.)
  - 4.1.2 Soils and Vadose Zone
  - 4.1.3 Groundwater
  - 4.1.4 Surface Water and Sediments
  - 4.1.5 Air

5.0 Contaminant Fate and Transport
- 5.1 Potential Routes of Migration (i.e., air, groundwater, etc.)
- 5.2 Contaminant Persistence
  - 5.2.1 If they are applicable (i.e., for organic contaminants), describe estimated persistence in the study area environment and the physical, chemical, and/or biological factors of importance for the media of interest.
- 5.3 Contaminant Migration
  - 5.3.1 Discuss factors affecting contaminant migration for the media of importance (e.g., sorption on soils, solubility in water, movement of groundwater, etc.)
  - 5.3.2 Discuss modeling methods and results, if applicable

6.0 Baseline Risk Assessment
- 6.1 Human Health Evaluation
  - 6.1.1 Exposure Assessment
  - 6.1.2 Toxicity Assessment
  - 6.1.3 Risk Characterization
- 6.2 Environmental Evaluation

7.0 Summary and Conclusions
- 7.1 Summary
  - 7.1.1 Nature and Extent of Contamination
  - 7.1.2 Fate and Transport
  - 7.1.3 Risk Assessment
- 7.2 Conclusions
  - 7.2.1 Data Limitations and Recommendations for Future Work
  - 7.2.2 Recommended Remedial Action Objectives

Appendices

A - Technical Memoranda on Field Activities (if available)
B - Analytical Data and QA/QC Evaluation Results
C - Risk Assessment Methods

Source: U.S. Environmental Protection Agency's 1988 *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final*, EPA/540/G-89/004.

8.0 FOCUSED FEASIBILITY STUDY

The purpose of the Focused FS (FFS) is to evaluate and analyze remedial action alternatives to minimize or eliminate exposure to sediment, surface water and groundwater contaminants at Site 39; groundwater contaminants at Site 40, and soil contaminants at Sites 7, 29, and 36. The FFS will be streamlined to consider only "No Action" and presumptive-remedy remedial actions. The FFS report will include a summary of RI results for each medium, a summary of site risks, identification of ARARs, identification of RAOs and general response actions, and an analysis of presumptive remedial technologies and alternatives. Sites 38 and PSC1485C are in the initial assessment phase, therefore no FFS is planned.

The approaches for screening remedial technologies, developing and screening remedial alternatives, and evaluating and analyzing alternatives in the FFS are presented in the following sections.

8.1 SCREENING OF TECHNOLOGIES AND REMEDIAL ALTERNATIVES

USEPA has reviewed and evaluated technologies that have consistently been selected for implementation at CERCLA sites. The presumptive remedies identified by USEPA for sites with VOCs in soils (USEPA 1993a) and contaminated groundwater (USEPA 1996a) will be considered for implementation at Sites 7, 29, 36, 39, and 40. It is anticipated that if any of the other currently investigated facility sites (perimeter road and industrial areas) require presumptive remedies the references mentioned above will be sufficient. The primary presumptive remedial technologies and process options that will be considered for Sites 7, 29, 36, 39, and 40 are listed in Table 8-1. Formal screening of other remedial technologies will not be performed unless data collected during the field investigation indicate that site conditions differ from those assumed for the presumptive remedies.

Remedial alternatives will be assembled using the presumptive remedial technologies that address each response objective established for the site. In addition to the "No Action" alternative, which is required under CERCLA to establish a baseline for comparison of alternatives, a number of other alternatives may be developed that focus on source and plume containment of the VOCs and DNAPLs in the soil and groundwater. A brief description of the components of each alternative developed will be provided in the FFS report.

TABLE 8-1

PRESUMPTIVE REMEDIAL ACTIONS
WORK PLAN FOR
SITES 5, 7, 29, 35, 40, and 39,
NAS WHITING FIELD
MILTON, FLORIDA
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Environmental Media	Presumptive Response Actions	Remedial Technologies	Process Options	Description	Evaluation Comments
Soil	No Action			No Action	Required by NCP to be carried through detailed analyses of alternatives for soil usage.
	Treatment	Soil Vapor Extraction	In Situ	A vacuum would be applied to wells screened in the contaminated zone to extract VOCs. Passive (barometic) or active (blower) vapor extraction could be used to extract VOCs.	Potentially viable.
		Thermal Desorption	Ex Situ	Contaminated soil would be excavated and transported off site for thermal desorption to remove the VOCs.	Potentially viable for near-surface soil.
		Incineration	Ex Situ	Contaminated soil would be excavated and transported off site for incineration to destroy VOCs.	Potentially viable for near-surface soil.
Groundwater	No Action			No Action.	Required by NCP to be carried through detailed analyses of alternatives for groundwater usage.
	Source Containment (DNAPLs)	Collection	Extraction Wells	A series of wells would be installed to extract free-phase DNAPLs.	Potentially viable. Source of free-phase DNAPLs would have to be identified.
	Plume Containment/ Restoration	Collection	Extraction Wells	A series of wells would be installed to extract contaminated groundwater.	Potentially viable. Might include wells in the plume to extract contaminated groundwater for treatment as well as downgradient wells to prevent migration of contaminated groundwater.
		In Situ Bioremediation	Natural Attenuation	Biodegradation, dispersion, dilution, and adsorption of contaminants in groundwater by natural processes would occur.	Potentially viable.
	Treatment	Biological Treatment	Aerobic	Aerobic microbes would be used to biodegrade organic waste.	Potentially viable for organics. Sludge produced.

TABLE 8-1

**PRESUMPTIVE REMEDIAL ACTIONS
WORK PLAN FOR
SITES 5, 7, 29, 35, 40, and 39
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 2**

Environmental Media	Presumptive Response Actions	Remedial Technologies	Process Options	Description	Evaluation Comments
Groundwater	Treatment (continued)	Biological Treatment	Anaerobic	Anaerobic microbes would be used to biodegrade organic wastes.	Potentially viable for organics. Sludge produced.
		Chemical Treatment	Chemical Oxidation	Oxidizing agents would be added to waste for oxidation of organics, sulfides, phenolics, and aromatic hydrocarbons to less toxic oxidation states.	Potentially viable.
			Enhanced Oxidation	Destruction of organic contaminants would be accomplished using oxidizing agents enhanced with, for example, ultraviolet light.	Potentially viable.
		Physical Treatment	GAC Adsorption	Contaminated water would be passed through a bed of adsorbent material so contaminants would adsorb on the surface.	Potentially viable.
			Air Stripping	Large volumes of air would be mixed with water in a packed column or through diffused aeration to promote the transfer of VOCs from liquid to air.	Potentially viable.
			Sedimentation	Suspended particles would be settled out as a pretreatment or primary treatment step.	Potentially viable.
			Filtration	Process would be used to filter out suspended particles. Might be preceded by a coagulation-and-flocculation step to increase the effectiveness of sand filtration.	Potentially viable.
	Disposal	Off-Site Discharge	POTW	Extracted groundwater would be discharged to the local POTW for further treatment.	Potentially viable. Would require extensive negotiations with POTW.
		On-Site Discharge	Surface Water Discharge	Treated effluent would be discharged to an adjacent surface water body. A federal and state NPDES permit would probably be required.	Potentially viable.

Source: U.S. Environmental Protection Agency's *Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with Volatile Organic Compounds in Soils* (EPA 540/F-93/048) and *Final Guidance: Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water of CERCLA Sites* (EPA 540/R-96/023)

Notes: DNAPL – Dense, nonaqueous-phase liquid
GAC – Granular activated carbon
NCP – National Oil and Hazardous Substances Contingency Plan
NPDES – National Pollutant Discharge Elimination System
POTW – Publicly owned treatment works
VOC – Volatile organic compound

8.2 EVALUATION OF ALTERNATIVES

Remedial alternatives will be evaluated in the FFS to provide information that will help decision makers select an appropriate remedial action for Site 39 (sediment, surface water and groundwater); Site 40 (groundwater contaminants), and Sites 7, 29 and 36 (soil contaminants). The evaluation process will consist of (1) a detailed description of the alternative's components, sufficient to support a conceptual design and a cost estimate accurate to +50/-30 percent; (2) an evaluation of each alternative against seven of USEPA's nine evaluation criteria (40 CFR Part 300) (state and community acceptance will be addressed in the Proposed Plan and ROD); and (3) a comparison of the alternatives relative to one another, with respect to the evaluation criteria.

Where appropriate, the description of alternatives may present preliminary design calculations, process flow diagrams, sizing of key components, and preliminary layouts and cross sections. The description may also include a discussion of limitations, assumptions, and uncertainties associated with each alternative. The seven criteria that will be used to evaluate each alternative are described below.

Overall protection of human health and the environment considers how risks identified in the CSM are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Compliance with ARARs identifies how the alternative meets the federal and state requirements regulating the chemical constituents, location of the site, and type of action to be implemented.

Long-term effectiveness and permanence considers the integrity of the system or component over time, long-term management of waste, and magnitude of risk associated with the waste's remaining in place.

Reduction of toxicity, mobility, or volume through treatment does not apply to the containment or other nontreatment components, but does apply to treatment components for "hot spots," groundwater, leachate, sediment, or landfill gas. This criterion considers the amount of material destroyed or treated and the degree of expected contaminant reduction. It also includes an evaluation of the irreversibility of the treatment technology.

Short-term effectiveness considers the impact on the surrounding community during construction and operation of the alternative. It also evaluates the amount of time required to achieve the response objectives.

Implementability includes several factors such as technical feasibility (i.e., the ability to construct and operate the alternative, the reliability of the technology, and the ability to monitor the effectiveness of the remedy); availability of materials and services; and administrative feasibility (i.e., the ease or difficulty of coordinating with or obtaining approvals from other agencies as well as the enforceability of deed restrictions).

Cost includes a line-item cost estimate for construction as well as operation and maintenance costs and a total-present-worth cost for the purpose of comparison with other alternatives. These cost estimates may be presented as a range of values with an accuracy of +50/-30 percent. The cost estimates will include a reasonable contingency factor to cover details and unforeseen circumstances. The estimates may be suitable for budgeting, but should not be considered the final construction cost estimates for the remedial action.

The *comparative analysis of alternatives* highlights the relative advantages and disadvantages of the alternatives for each of the seven evaluation criteria. This analysis will be presented as a written discussion for each alternative and will be summarized in tabular format for ease of comparison.

8.3 FINAL FOCUSED FEASIBILITY STUDY

The final FFS will be signed, sealed, and dated by the Florida Registered Professional Engineer responsible for its preparation.

9.0 PROJECT SCHEDULE

The proposed start for the field investigation is January 17, 2000. Field activities are expected to take a minimum of six months. This schedule is based on assumed site conditions and will be updated during Whiting Field Partnering Team meetings to reflect actual progress during the project.

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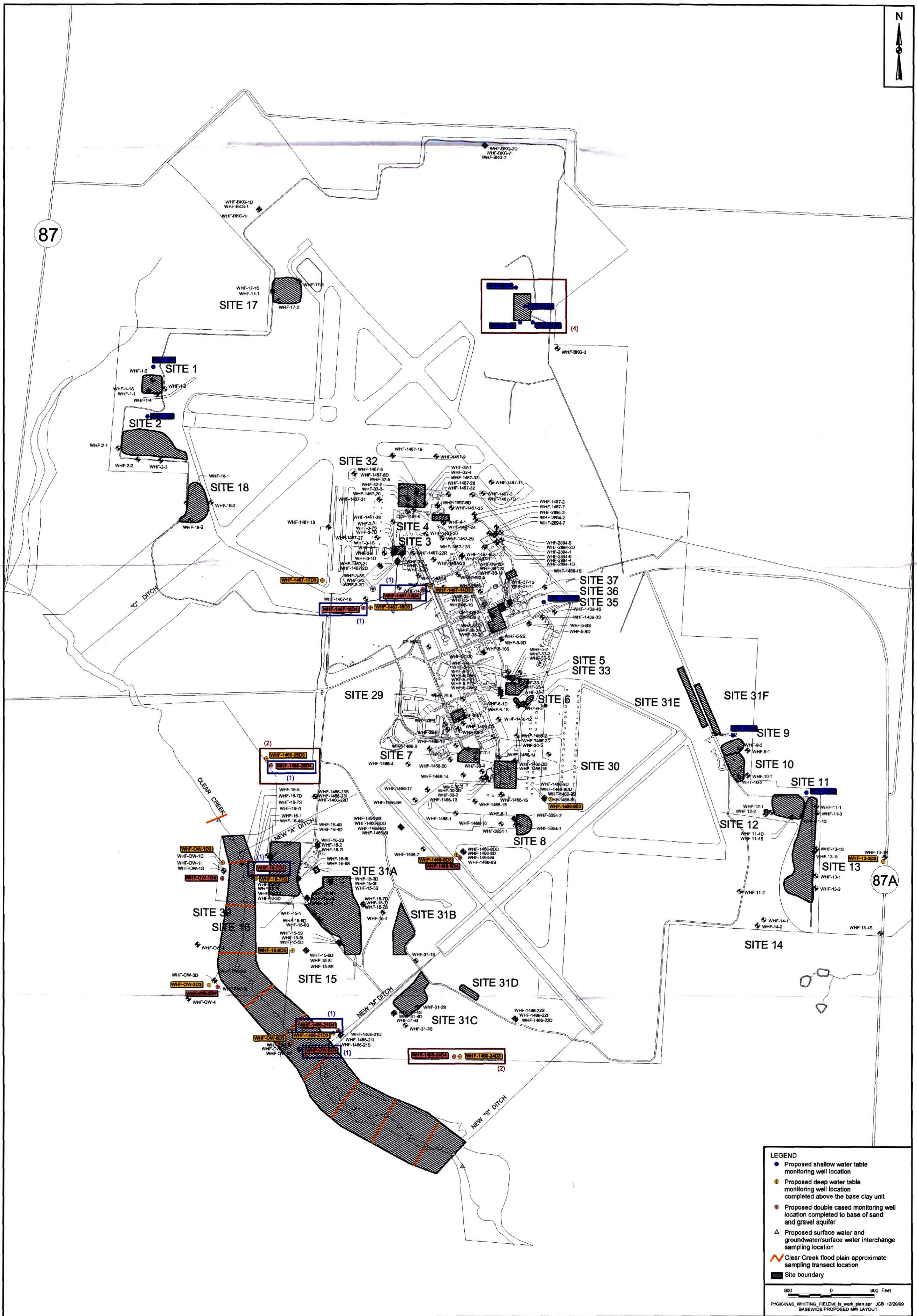

DRAWN BY	DATE		PROPOSED MONITORING WELLS, MONITORING WELLS, AND SITE LOCATIONS RI/FS WORK PLAN SITES 5, 7, 29, 35, 38, 39, 40 AND PSC 1485C NAS WHITING FIELD MILTON, FLORIDA	CONTRACT NO. 0052	
J. BELLONE	12/29/99			OWNER NO.	
CHECKED BY	DATE			APPROVED BY	DATE
	DATE				
SCALE AS NOTED				DRAWING NO. PLATE 1	REV. 0

APPENDIX A

SUMMARY OF POTENTIAL FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

TABLE A-1

SUMMARY OF POTENTIAL FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
WORK PLAN FOR
SITES 5, 7, 29, 35, 38, 39, 40, AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA

Federal Standards and Requirements	Requirements Synopsis	ARAR Type	Consideration in the Remedial Response Process
Clean Air Act (CAA), National Ambient Air Quality Standards (NAAQs) [40 Code of Federal Regulations (CFR) Part 50]	Establishes primary (health-based) and secondary (welfare-based) air quality standards for carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, and sulfur oxides emitted from a major source of air emissions.	Action-specific	NAAQs are potential relevant and appropriate requirements for cleanup activities. The principal application of these standards is during remedial activities resulting in exposures through dust and vapors.
Clean Water Act (CWA) Regulations, National Pollutant Discharge Elimination System (NPDES) (40 CFR Parts 122 and 125)	Requires permits specifying the permissible concentration or level of contaminants in the effluent for the discharge of pollutants from any point source into waters of the United States.	Action-specific	Discharge during remedial activities to surface waters may require that an NPDES permit be obtained and that both the substantive and administrative NPDES requirements be met.
CWA Regulations, National Pretreatment Standards (40 CFR Part 403)	Sets pretreatment standards through the National Categorical Standards or the General Pretreatment Regulations for the introduction of pollutants from nondomestic sources into publicly owned treatment works (POTWs) to control pollutants that pass through, cause interference with, or are otherwise incompatible with treatment processes at a POTW.	Action-specific	If groundwater is discharged to a POTW, the discharge must meet local limits imposed by the POTW. A discharge from a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site must meet the POTW's pretreatment standards in the effluent to the POTW. Discharge to a POTW is considered an off-site activity and is, therefore, subject to both the substantive and administrative requirements of this rule.
CWA Regulations, Toxic Pollutant Effluent Standards (40 CFR Part 129)	Regulates the concentration of a toxic pollutant in navigable waters that shall not result in adverse impacts to aquatic life or to consumers of aquatic life.	Chemical-specific	This rule is a potential applicable or relevant and appropriate requirement (ARAR) for sites that may discharge regulated pollutants to surface water. These standards may be incorporated into NPDES permits where applicable for off-site discharge of surface water.
Occupational Safety and Health Act (OSHA) Regulations, General Industry Standards (29 CFR Part 1910)	Requires establishment of programs including employee training requirements to ensure worker health and safety at hazardous waste sites.	Action-specific	Under 40 CFR Part 300.38, requirements apply to all response activities under the National Oil and Hazardous Substances Contingency Plan.
OSHA Regulations (29 CFR Part 1910, Subpart Z)	Establishes permissible exposure limits for workplace exposure to a specific list of chemicals.	Chemical-specific	These standards are applicable for worker exposure to OSHA hazardous chemicals during remediation activities.
OSHA Regulations, Recordkeeping, Reporting, and Related Regulations (29 CFR Part 1904)	Provides recordkeeping and reporting requirements applicable to remediation activities.	Action-specific	These requirements apply to all site contractors and subcontractors and must be followed during all site work.

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NAS WHITING FIELD
MILTON, FLORIDA

Federal Standards and Requirements	Requirements Synopsis	ARAR Type	Consideration in the Remedial Response Process
OSHA Regulations, Health and Safety Standards (29 CFR Part 1926)	Specifies the type of safety training, equipment, and procedures to be used during site investigation and remediation.	Action-specific	All phases of the remedial response project should be executed in compliance with these regulations.
Resource Conservation and Recovery Act (RCRA) Regulations, Identification and Listing of Hazardous Waste (40 CFR Part 261)	Defines those solid wastes that are subject to regulation as hazardous wastes under 40 CFR Parts 262–265.	Action-specific	These requirements define RCRA–regulated wastes, thereby delineating acceptable management approaches for listed and characteristically hazardous wastes that should be incorporated into the characterization and remediation elements of remedial response projects.
RCRA Regulations, Contingency Plan and Emergency Procedures (40 CFR Part 264, Subpart D)	Outlines requirements for emergency procedures to be used following explosions, fires, etc.	Action-specific	These requirements are relevant and appropriate for remedial actions involving the management of hazardous waste.
RCRA Regulations, Use and Management of Containers (40 CFR Part 264, Subpart I)	Sets standards for the storage of containers of hazardous waste.	Action-specific	This requirement applies if a remedial alternative involves the storage of containers of RCRA hazardous waste. Additionally, the staging of study-generated RCRA wastes should meet the intent of the regulation.
RCRA Regulations, Land Disposal Restrictions (LDRs) (40 CFR Part 268)	Establishes restrictions on land disposal of untreated hazardous wastes and provides treatment standards for hazardous wastes.	Action-specific	Under the LDRs, treatment standards have been established for all listed wastes. If it is determined that hazardous wastes are considered subject to LDRs, the material must be handled and treated in compliance with these regulations. Universal Treatment Standards (UTSs) for organic constituents of hazardous wastes have been promulgated under this rule. The UTSs became effective on December 19, 1994.
Safe Drinking Water Act (SDWA) Regulations, Maximum Contaminant Level Goals (MCLGs) (40 CFR Part 141)	Establishes drinking water quality goals at levels of no known or anticipated adverse health effects with an adequate margin of safety. These criteria do not consider treatment feasibility or cost elements.	Chemical-specific	MCLGs greater than zero are relevant and appropriate standards for groundwater or surface waters that are current or potential sources of drinking water.
SDWA Regulations, National Primary Drinking Water Standards, Maximum Contaminant Levels (MCLs) (40 CFR Part 141)	Establishes enforceable standards for specific contaminants that have been determined to adversely affect human health. These standards, MCLs, are protective of human health for individual chemicals and are developed using MCLGs, available treatment technologies, and cost data.	Chemical-specific	MCLs established by the SDWA are relevant and appropriate standards where the MCLGs are not determined to be ARARs. MCLs apply to groundwater or surface waters that are current or potential drinking water sources.

TABLE A-1

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MILTON, FLORIDA

Federal Standards and Requirements	Requirements Synopsis	ARAR Type	Consideration in the Remedial Response Process
SDWA Regulations, National Secondary Drinking Water Standards (SMLCs) (40 CFR Part 143)	Establishes welfare-based standards for public water systems for specific contaminants or water characteristics that may affect the aesthetic qualities of drinking water.	Chemical-specific	SMCLs are nonenforceable limits intended as guidelines for use by states in regulating water supplies.
Toxic Substance Control Act Polychlorinated Biphenyl (PCB) Requirements (40 CFR 761)	Establishes criteria for the cleanup of PCBs.	Chemical-specific; location-specific	These requirements may be relevant and appropriate for sites contaminated with PCBs.
U.S. Environmental Protection Agency (USEPA) Region III Soil Risk-Based Concentrations (RBCs) (USEPA Region III Office of RCRA, Technical Memo, June 1996)	Establishes health-based screening criteria for chemicals of concern in soils.	Chemical-specific; guidance to be considered (TBC)	These guidelines are used in the screening process to determine chemicals of potential concern.

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NAS WHITING FIELD
MILTON, FLORIDA

State Citations*	Requirements Synopsis	ARAR Type	Consideration in the Remedial Response Process
Chapter 62-2, Florida Administrative Code (FAC), Florida Air Pollution Rules, October 1992	Establishes permitting requirements for owners or operators of any source that emits any air pollutant. This rules also establishes ambient air quality standards for sulfur dioxide, PM_{10}, carbon monoxide, and ozone.	Action-specific	Where remedial action could result in release of regulated contaminants to the atmosphere, such as may occur during air stripping, this regulation would be a potential ARAR.
Chapter 62-4, FAC, Florida Rules on Permits, February 1994	Establishes procedures for obtaining permits for sources of pollution.	Action-specific	The substantive permitting requirements must be met during a CERCLA remediation. Both substantive and administrative requirements must be met for non–CERCLA activities.
Chapter 62-302, FAC, Florida Surface Water Standards, August 1994	Defines classifications of surface waters and establishes water quality standards (WQSs) for surface water within the classifications. The state's antidegradation policy is also established in this rule.	Chemical-specific; location-specific	Remedial actions that potentially impact surface waters of the state will consider surface WQSs. WQSs may also be relevant and appropriate ARARs for groundwater if no MCL exists, groundwater discharges to surface water and contaminants are affecting aquatic organisms, or other health-based standards are not available.
Chapter 62-520, FAC, Florida Water Quality Standards, April 1994	Establishes the groundwater classification system for the state and provides qualitative minimum criteria for groundwater based on the classification.	Chemical-specific; location-specific	Drinking water standards are established in Rule 62-550 for current or potential sources of potable water. The classification system established in this rule defines potable water sources (F-I, G-I, and G-II waters).
Chapter 62-522, FAC, Groundwater Permitting and Monitoring Requirements, April 1994	Establishes permitting and monitoring requirements for installations discharging to groundwater.	Action-specific	This rule should be considered when discharge to groundwater is a possible remedial action.
Chapter 62-532, FAC, Florida Water Well Permitting and Construction Requirements, March 1992	Establishes the minimum standards for the location, construction, repair, and abandonment of water wells. Permitting requirements and procedures are established.	Action-specific	The substantive requirements for permitting may be potential ARARs for remedial actions involving the construction, repair, or abandonment of monitoring, extraction, or injection wells.
Chapter 62-550, FAC, Florida Drinking Water Standards, September 1994	Implements the federal SDWA by adopting the national primary and secondary drinking water standards and by creating additional rules to fulfill state and federal requirements.	Chemical-specific; Location-specific	MCLs are commonly considered applicable regulations for aquifers and related groundwater classified as a current or potential potable water supply source. MCLs should be considered ARARs during a cleanup of groundwater or surface waters that are current or potential sources of drinking water.

TABLE A-1

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NAS WHITING FIELD
MILTON, FLORIDA

State Citations*	Requirements Synopsis	ARAR Type	Consideration in the Remedial Response Process
Chapter 62-650, FAC, Florida Water Quality-Based Effluent Limitations, November 1989	States that all activities and discharges, except dredge and fill, must meet effluent limitations based on technology or water quality.	Chemical-specific; action-specific	All activities and discharges, other than dredge and fill activities, are required to meet effluent limitations based on technology (technology-based effluent limit) and/or water quality (water-quality-based effluent limit), as defined in this rule. The substantive permitting requirement established in this rule may be potentially relevant and appropriate ARARs for remedial actions where treated water is discharged to a surface water body.
Chapter 62-660, FAC, Florida Industrial Wastewater Facilities Regulations, May 1994	Sets minimum treatment standards for effluent based on water quality considerations and technology. Also establishes general permit requirements for four specific operations.	Action-specific	This rule may be a potentially relevant and appropriate ARAR for remedial actions that involve discharge of treated water to surface waters of the state if surface water standards are either not available or are not sufficiently protective.
Chapter 62-730, FAC, Florida Hazardous Waste Rules, October 1993	Adopts by reference appropriate sections of 40 CFR and establishes minor additions to these regulations concerning the generation, storage, treatment, transportation, and disposal of hazardous wastes.	Action-specific	The substantive permitting requirements for hazardous waste must be met where applicable for remedial actions.
Chapter 62-736, FAC, Florida Rules on Hazardous Waste Warning Signs, July 1991	Requires warning signs at National Priority List (NPL) and Florida Department of Environmental Protection (FDEP)–identified hazardous waste sites to inform the public of the presence of potentially harmful conditions.	Action-specific	This requirement is applicable for sites that are on the NPL or that have been identified by the FDEP as potentially harmful.
Chapter 62-775, FAC, Florida Soil Thermal Treatment Facilities Regulations, November 1992	Establishes criteria for the thermal treatment of petroleum- or petroleum-product-contaminated soils. The rule further outlines procedures for excavating, receiving, handling, and stockpiling contaminated soils before thermal treatment in both stationary and mobile facilities.	Chemical-specific; action-specific	The soil cleanup values established in this rule for total recoverable petroleum hydrocarbons; volatile hydrocarbons; metals; and benzene, toluene, ethylbenzene, and xylenes may be potentially relevant and appropriate ARARs for contaminated soils. This requirement does not apply to soils classified as hazardous. Procedures for excavating, receiving, handling, and stockpiling contaminated soils before thermal treatment are ARARs for remedial alternatives involving thermal treatment of soils.

TABLE A-1

SUMMARY OF POTENTIAL FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
WORK PLAN FOR
SITES 5, 7, 29, 35, 38, 39, 40, AND PSC 1485C
NAS WHITING FIELD
MILTON, FLORIDA

State Citations*	Requirements Synopsis	ARAR Type	Consideration in the Remedial Response Process
Chapter 62-777, FAC, Contaminant Cleanup Target Levels, (Proposed adoption date March 1999)	Establishes criteria to be considered in determining cleanup goals for -contaminated soil and water.	Chemical-specific; TBC	The soil and groundwater cleanup criteria established in this rule are potential ARARs for sites with contamination.
Chapter 40A-3, FAC, Regulation of Well, Northwest Florida Water Management District	Establishes well permitting regulations in the Northwest Florida Water Management District.	Action-specific; location-specific	Well permitting rules and regulations must be considered before installing wells.

* Date following the state citation is either the date originally promulgated or the date of the most recent amendment.

APPENDIX B

FIELD INVESTIGATION STANDARD OPERATING PROCEDURES

BROWN & ROOT ENVIRONMENTAL	STANDARD OPERATING PROCEDURES	Number SA-6.1	Page 1 of 23
		Effective Date 03/01/96	Revision 0
		Applicability B&R Environmental, NE	
		Prepared Earth Sciences Department	
Subject NON-RADIOLOGICAL SAMPLE HANDLING		Approved D. Senovich	

TABLE OF CONTENTS

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide information on sample preservation, packaging, and shipping procedures to be used in handling environmental samples submitted for chemical constituent, biological, or geotechnical analysis. Sample chain-of-custody procedures and other aspects of field documentation are addressed in SOP SA-6.3. Sample identification is addressed in SOP CT-04.

2.0 SCOPE

This procedure:

- Describes the appropriate containers to be used for samples depending on the analyses to be performed, and the steps necessary to preserve the samples when shipped off site for chemical analysis.

- Provides instruction for sample packaging and shipping in accordance with current U.S. Department of Transportation (DOT) regulations.

3.0 GLOSSARY

Hazardous Material - A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. Under 49 CFR, the term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials, as well as materials designated as hazardous under the provisions of §172.101 and §172.102 and materials that meet the defining criteria for hazard classes and divisions in Part 173.

Hazardous Waste - Any substance listed in 40 CFR, Subpart D (y261.30 et seq.), or otherwise characterized as ignitable, corrosive, reactive, or toxic (as defined by Toxicity Characteristic Leaching Procedure, TCLP, analysis) as specified under 40 CFR, Subpart C (y261.20 et seq.), that would be subject to manifest requirements specified in 40 CFR 262. Such substances are defined and regulated by EPA.

Marking - A descriptive name, identification number, instructions, cautions, weight, specification or UN marks, or combination thereof required on outer packaging of hazardous materials.

n.o.i - Not otherwise indicated (may be used interchangeably with n.o.s.).

n.o.s. - Not otherwise specified.

ORM - Other regulated material (see DOT 49 CFR 173.144).

Packaging - A receptacle and any other components or materials necessary for compliance with the minimum packaging requirements of 49 CFR 174, including containers (other than freight containers or overpacks), portable tanks, cargo tanks, tank cars, and multi-unit tank-car tanks to perform a containment function in conformance with the minimum packaging requirements of 49 CFR 173.24(a) & (b).

Placard - Color-coded, pictorial sign which depicts the hazard class symbol and name and which is placed on the side of a vehicle transporting certain hazardous materials.

Common Preservatives:

- Hydrochloric Acid - HCl
- Sulfuric Acid - H_2SO_4
- Nitric Acid - HNO_3
- Sodium Hydroxide - NaOH

Other Preservatives

- Zinc Acetate
- Sodium Thiosulfate - $Na_2S_2O_3$

Normality (N) - Concentration of a solution expressed as equivalent per liter, an equivalent being the amount of a substance containing 1 gram-atom of replaceable hydrogen or its equivalent. Thus, a one-molar solution of HCl, containing 1 gram-atom of H, is "one normal," whereas a one-molar solution of H_2SO_4, containing 2 gram-atoms of H, is "two normal."

Reportable Quantity (RQ) - For the purposes of this SOP, means the quantity specified in column 3 of the Appendix to DOT 49 CFR §172.101 for any material identified in column 1 of the appendix. A spill greater than the amount specified must be reported to the National Response Center.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the location and time of collection.

4.0 RESPONSIBILITIES

Field Operations Leader - Directly responsible for the bottling, preservation, labeling, packaging, shipping, and custody of samples up to and including release to the shipper.

Field Samplers - Responsible for initiating the Chain-of-Custody Record (per SOP SA-6.3), implementing the packaging and shipping requirements, and maintaining custody of samples until they are relinquished to another custodian or to the common carrier.

5.0 PROCEDURES

Sample identification, labeling, documentation, and chain-of-custody are addressed by SOP SA-6.3.

5.1 Sample Containers

Different types of chemicals react differently with sample containers made of various materials. For example, trace metals adsorb more strongly to glass than to plastic, whereas many organic chemicals may dissolve various types of plastic containers. Attachments A and B show proper containers (as well as other information) per 40 CFR 136. In general, the sample container shall allow approximately 5-10 percent air space ("ullage") to allow for expansion/vaporization if the sample warms during transport. However, for collection of volatile organic compounds, head space shall be omitted. The analytical laboratory will generally provide certified-clean containers for samples to be analyzed for chemical constituents. Shelby tubes or other sample containers are generally provided by the driller for samples requiring geotechnical analysis. Sufficient lead time shall be allowed for a delivery of bottle orders. Therefore, it is critical to use the correct container to maintain the integrity of the sample prior to analysis.

Once opened, the container must be used at once for storage of a particular sample. Unused but opened containers are to be considered contaminated and must be discarded; because of the potential for introduction of contamination, they cannot be reclosed and saved for later use. Likewise, any unused containers which appear contaminated upon receipt, or which are found to have loose caps or a missing Teflon liner (if required for the container), shall be discarded.

5.2 Sample Preservation

Many water and soil samples are unstable and therefore require preservation to prevent changes in either the concentration or the physical condition of the constituent(s) requiring analysis. Although complete and irreversible preservation of samples is not possible, preservation does retard the chemical and biological changes that inevitably take place after the sample is collected. Preservation techniques are usually limited to pH control, chemical addition(s), and refrigeration/ freezing (certain biological samples only).

5.2.1 Overview

The preservation techniques to be used for various analytes are listed in Attachments A and B. Reagents required for sample preservation will either be added to the sample containers by the laboratory prior to their shipment to the field or be added in the field (in a clean environment). Only high purity reagents shall be used for preservation. In general, aqueous samples of low-concentration organics (or soil samples of low- or medium-concentration organics) are cooled to 4°C. Medium-concentration aqueous samples and high-hazard organics samples are typically not preserved. Low-concentration aqueous samples for metals are acidified with HNO_3, whereas medium-concentration and high-hazard aqueous metal samples are not preserved. Low- or medium-concentration soil samples for metals are cooled to 4°C, whereas high-hazard samples are not preserved.

The following subsections describe the procedures for preparing and adding chemical preservatives. Attachments A and B indicate the specific analytes which require these preservatives.

5.2.2 Preparation and Addition of Reagents

Addition of the following acids or bases may be specified for sample preservation; these reagents shall be analytical reagent (AR) grade or purer and shall be diluted to the required concentration with deionized water before field sampling commences. To avoid uncontrolled reactions, be sure to Add Acid to water (not vice versa). A dilutions guide is provided below.

Acid/Base	Dilution	Concentration	Estimated Amount Required for Preservation
Hydrochloric Acid (HCl)	1 part concentrated HCl: 1 part double-distilled, deionized water	6N	5-10 mL
Sulfuric Acid (H_2SO_4)	1 part concentrated H_2SO_4: 1 part double-distilled, deionized water	18N	2 - 5 mL
Nitric Acid (HNO_3)	Undiluted concentrated HNO_3	16N	2 - 5 mL
Sodium Hydroxide (NaOH)	400 grams solid NaOH dissolved in 870 mL double-distilled, deionized water; yields 1 liter of solution	10N	2 mL

The amounts required for preservation shown in the above table assumes proper preparation of the preservative and addition of the preservative to one liter of aqueous sample (assuming that the sample is initially at pH 7, is poorly buffered, and does not contain particulate matter; as these conditions vary, more preservative may be required). Consequently, the final sample pH must be checked using narrow-range pH paper, as described in the generalized procedure detailed below:

- Pour off 5-10 mL of sample into a dedicated, clean container. Use some of this sample to check the initial sample pH using wide range (0-14) pH paper. Never dip the pH paper into the sample; always apply a drop of sample to the pH paper using a clean stirring rod or pipette.

- Add about one-half of the estimated preservative required to the original sample bottle. Cap and invert gently several times to mix. Check pH (as described above) using medium range pH paper (pH 0-6 or pH 7.5-14, as applicable).

- Cap sample bottle and seal securely.

Additional considerations are discussed below:

- To test if ascorbic acid must be used to remove oxidizing agents present in the sample before it can be properly preserved, place a drop of sample on KI-starch paper. A blue color indicates the need for ascorbic acid addition.

  If required, add a few crystals of ascorbic acid to the sample and retest with the KI-starch paper. Repeat until a drop of sample produces no color on the KI-starch paper. Then add an additional 0.6 grams of ascorbic acid per each liter of sample volume.

  Continue with proper base preservation of the sample as described, generally, above.

- Samples for sulfide analysis must be treated by the addition of 4 drops (0.2 mL) of 2N zinc acetate solution per 100 ml of sample.

  The 2N zinc acetate solution is made by dissolving 220 grams of zinc acetate in 870 mL of double-distilled, deionized water to make 1 liter of solution.

  The sample pH is then raised to 9 using the NaOH preservative.

- To test of sodium thiosulfate must be added to remove residual chlorine from a sample, test the sample for residual chlorine using a field test kit especially made for this purpose.

  If residual chlorine is present, add 0.08 grams of sodium thiosulfate per liter of sample to remove the residual chlorine.

  Continue with proper acidification of the sample as described, generally, above.

For biological samples, 10% buffered formalin or isopropanol may also be required for preservation. Questions regarding preservation requirements should be resolved through communication with the laboratory <u>before</u> sampling begins.

5.3 Field Filtration

At times, field-filtration may be required to provide for the analysis of dissolved chemical constituents. Field-filtration must be performed prior to the preservation of samples as described above. General procedures for field filtration are described below:

- The sample shall be filtered through a non-metallic, 0.45-micron membrane filter, immediately after collection. The filtration system shall consist of dedicated filter canister, dedicated silicon tubing, and a peristaltic pump with pressure or vacuum pumping squeeze action (since the sample is filtered by mechanical peristalsis, the sample travels only through the tubing).

- To perform filtration, thread the silicon tubing through the peristaltic pump head. Attach the filter canister to the discharge end of the silicon tubing (note flow direction arrow); attach the aqueous sample container to the intake end of the silicon tubing. Turn the peristaltic pump on and perform filtration.

- Continue by preserving the filtrate (contained in the filter canister), as applicable and generally described above.

5.4 Sample Packaging and Shipping

Samples collected for shipment from a site shall be classified as either environmental or hazardous material samples. Samples from drums containing materials other than Investigative Derived Waste (IDW) and samples obtained from waste piles or bulk storage tanks are generally shipped as hazardous materials. A distinction must be made between the two types of samples in order to:

- Determine appropriate procedures for transportation of samples (if there is any doubt, a sample shall be considered hazardous and shipped accordingly.)

- Protect the health and safety of transport and laboratory personnel receiving the samples (special precautions are used by the shipper and at laboratories when hazardous materials are received.)

Detailed procedures for packaging environmental and hazardous material samples are outlined in the remainder of this section.

5.4.1 Environmental Samples

Environmental samples are packaged as follows:

- Place sample container, properly identified and with lid securely fastened in a plastic bag (e.g. Ziploc baggie), and seal the bag.

- Place sample in a cooler constructed of sturdy material which has been lined with a large, plastic (e.g. "garbage" bag).

- Pack with enough noncombustible, absorbent, cushioning materials such as vermiculite (shoulders of bottles must be iced if required) to minimize the possibility of the container breaking.

- If cooling is required (see Attachments A and B), double-bag ice in Ziploc baggies and place around container shoulders, and on top of absorbent packing material (minimum of 8 pounds of ice for a medium-size cooler).

- Seal (i.e., tape or tie top in knot) large liner bag.

- The original (top, signed copy) and extra carbonless copies of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the first cooler. The COC form should then state how many coolers are included with that shipment.

- Close and seal outside of cooler as described in SOP SA-6.3. Signed custody seals must be used.

Coolers must be marked as containing "Environmental Samples." The appropriate side of the container must be marked "This End Up" and arrows placed appropriately. No DOT marking or labeling is required; there are no DOT restrictions on mode of transportation.

5.4.2 Determination of Shipping Classification for Hazardous Material Samples

Samples not determined to be environmental samples, or samples known or expected to contain hazardous materials, must be considered hazardous material samples and transported according to the requirements listed below.

5.4.2.1 Known Substances

If the substance in the sample is known or can be identified, package, mark, label, and ship according to the specific instructions for that material (if it is listed) in the DOT Hazardous Materials Table, 49 CFR 172.101. (DOT Guide for shippers can be found in Attachment D of this document.)

To determine the proper shipping name, use the following steps to help locate the shipping name on the Hazardous Materials Table, DOT 49 CFR 172.101.

1. Look first for the chemical or technical name of the material, for example, ethyl alcohol. Note that many chemicals have more than one technical name, for example, perchloroethylene (not listed in 172.101) is listed as tetrachloroethylene (listed 172.101). It may be useful to consult a chemist for all possible technical names a material can have. If your material is not listed by its technical name, then . . .

2. Look for the chemical family name For example, pentyl alcohol is not listed but the chemical family name is: alcohol, n.o.s. (not otherwise specified). If the chemical family name is not listed, then . . .

3. Look for a generic name based on end use. For example, Paint, n.o.s or Fireworks, n.o.s. If a generic name based on end use is not listed, then . . .

4. Look for a generic family name based on end use, for example, drugs, n.o.s. or cosmetics, n.o.s. Finally, if your material is not listed by a generic family name but you suspect or know the material is hazardous because it meets the definition of one or more hazardous classes, then . . .

5. You will have to use the general hazard class for a proper shipping name. For example, Flammable Liquid, n.o.s, or Oxidizer, n.o.s.

5.4.2.2 Unknown Substances

For samples of hazardous substances of unknown content, select the appropriate transportation category according to the DOT hazardous materials classification of a material having more than one hazard. This procedure is outlined in DOT Regulation 49 CFR 173.2a. (This can be found in Attachment C of this SOP.)

The correct shipping classification for an unknown sample is selected through a process of elimination, as outlined in DOT Regulation 49 CFR 172.101(c)(11). By using the provisions in this paragraph, the proper shipping name and description will be determined. A step-by-step guide is provided by the Department of Transportation (DOT) and can be found in Attachment D of this SOP.

5.4.3 Packaging and Shipping of Samples Classified as Flammable Liquid (or Solid)

5.4.3.1 Packaging

Applying the word "flammable" to a sample does not imply that it is in fact flammable. The word prescribes the class of packaging according to DOT regulations.

1. Containerize sample as required (see Attachments A and B). To prevent leakage, fill container no more than 90 percent full. Seal lid with teflon tape or wire.

2. Complete sample label and attach securely to sample container.

3. Seal container and place in 2-mil-thick (or thicker) polyethylene bag (e.g., Ziploc baggie), one sample per bag. Position sample identification label so that it can be read through bag. Seal bag.

4. For soil jars, place sealed bag inside metal can (available from laboratory or laboratory supplier) and cushion it with enough noncombustible, absorbent material (for example, vermiculite or diatomaceous earth) between the bottom and sides of the can and bag to prevent breakage and absorb leakage. Pack one bag per can. Use clips, tape, or other positive means to hold can lid securely, tightly and permanently. Mark can as indicated in Paragraph 1 of Section 5.3.4.2, below. Single 1-gallon bottles do not need to be placed in metal cans.

5. Place one or more metal cans (or a single 1-gallon bottle) into a strong outside container, such as a metal picnic cooler or a DOT-approved fiberboard box. Surround cans (or bottle) with noncombustible, absorbent cushioning materials for stability during transport. The absorbent material should be able to absorb the entire contents of the container. Mark container as indicated in Paragraph 2 below.

5.4.3.2 Marking/Labeling

1. Use abbreviations only where specified. Place the following information, either hand-printed or in label form, on the metal can (or 1-gallon bottle):

   - Laboratory name and address.

- Proper shipping name from the hazardous materials table (DOT Regulation CFR 49 172.101). Example: "Flammable Liquid, n.o.s. UN1993" or "Flammable Solid, n.o.s. UN1325." This will include packing group (see Section 5.3.4.2, No. 2.)

Not otherwise specified (n.o.s) is not used if the flammable liquid (or solid) is identified. If identified, the name of the specific material is listed before the category (for example, Acetone, Flammable Liquid), followed by its appropriate UN number found in the DOT Hazardous Materials table (49 CFR 172.101).

2. Determine packing group. The packing group is part of the proper shipping name and must be included on the shipping papers in the description section.

   I. Most Hazardous
   II. Medium Hazard
   III. Least Hazardous

   The packing group will be listed in the hazardous materials table, column 5.

3. Place all information on outside shipping container as on can (or bottle), specifically:

   - Proper shipping name
   - UN or NA number
   - Proper label(s)
   - Addressee and sender

   Place the following labels on the outside shipping container: "Cargo Aircraft Only" and DOT label such as: "Flammable Liquid" (or "Flammable Solid"). "Dangerous When Wet" label shall be used if the Flammable Solid has not been exposed to a wet environment. "Laboratory Samples" and "THIS SIDE UP" or "THIS END UP" shall also be marked on the top of the outside container, and upward-pointing arrows shall be placed on all four sides of the container.

5.4.3.3 <u>Shipping Papers</u>

1. Use abbreviations only where specified. Complete the carrier-provided bill of lading and sign certification statement. Provide the following information in the order listed (one form may be used for more than one exterior container):

   - Proper shipping name. (Example: "Flammable Liquid, n.o.s. UN1993" or "Flammable Solid, n.o.s. UN1325 Packing Group I, II, III").

   - "Limited Quantity" (or "Ltd. Qty."). (See No. 3, below.)

   - "Cargo Aircraft Only."

   - Net weight (wt) or net volume (vol), just before or just after "Flammable Liquid, n.o.s." or "Flammable Solid, n.o.s.," by item, if more than one metal can is inside an exterior container.

   - "Laboratory Samples" (if applicable).

2. Include Chain-of-Custody Record, properly executed in outside container; use custody seals.

3. "Limited Quantity" means the maximum amount of a hazardous material for which there is a specific labeling or packaging exception (DOT CFR 49 171.8). This may mean that packages are exempted from labeling requirements. To determine if your sample meets the Limited Quantity Exception, refer to DOT Regulation CFR 49 Subpart C 173.50 through 173.156. First, determine the proper classification and shipping name for the material; then refer to the exception requirements for that particular class of material beginning with 173.50.

   Example: "Flammable Liquid n.o.s. UN1993 Packing Group 1." The outer package can weigh no more than 66 pounds gross weight. The inner package or container can weigh no more than 0.1 gallon net capacity for each container.

   To determine whether the material can be shipped as a "Limited Quantity," you must check the specific requirement for that class of material.

5.4.3.4 Transportation

1. The majority of unknown hazardous substance samples will be classified as flammable liquids. The samples will be transported by rented or common carrier truck, railroad, or express overnight package services. Do not transport samples on any passenger-carrying air transport system, even if the system has cargo-only aircraft. DOT regulations permit regular airline cargo-only aircraft, but difficulties with most suggest avoiding them. Instead, ship by airline carriers that carry only cargo. If unsure of what mode of transportation to use, consult the FOL or Project Manager.[1]

2. For transport by government-owned vehicle, including aircraft, DOT regulations do not apply. However, procedures described above, with the exception of execution of the bill of lading with certification, shall still be followed.

3. Use the hazardous materials shipping check list (Attachment E) as a guidance to ensure that all sample-handling requirements are satisfied.

4. In some cases, various materials may react if they break during shipment. To determine if you are shipping such materials, refer to the DOT compatibility chart in Attachment F.

5.5 Shipment of Lithium Batteries

Monitoring well data are analyzed using either the Hermit SE 1000 or the Hermit SE 2000 environmental data logger. These instruments are powered by lithium batteries. The Department of Transportation has determined that lithium batteries are a hazardous material and are to be shipped using the following information:

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[1] Note: If you are unsure as how to ship the sample (hazardous or environmental sample), contact the FOL or Project Manager so that a decision can be made as to the proper shipping practices. The DOT penalties for improper shipment of a hazardous material are stringent and may include a prison term for intentional violations.

- Product Designation
  - Hermit SE 1000
  - Hermit SE 2000

- DOT Proper Shipping Name
  - Lithium batteries, contained in equipment, UN3091

- Classification or Division
  - Class 9

Shipment of equipment containing lithium batteries must be accompanied by shipping papers completed as indicated in Attachment G. The instrument will be shipped by Federal Express as a Hazardous Material. Place the instrument in the same container in which it was received. This container or case is a DOT-approved shipping container. For Federal Express procedures to ship hazardous materials, call 1-800-238-5355, extension 922-1666. In most cases, the return shipping papers and DOT labels will be shipped to you from the company warehouse or the vendor. An example of the types of labels used for shipment and the wording are shown in Attachment G. These labels will be attached to the outside container with the following wording:

- Lithium Batteries Contained in Equipment
  - UN-3091
  - Shipped Under CA-9206009

6.0 REFERENCES

American Public Health Association, 1981. Standard Methods for the Examination of Water and Wastewater, 15th Edition. APHA, Washington, D.C.

U.S. Department of Transportation, 1993. Hazardous Materials Regulations, 49 CFR 171-177.

U.S. EPA, 1984. "Guidelines Establishing Test Procedures for the Analysis of Pollutants under Clean Water Act." Federal Register, Volume 49 (209), October 26, 1984, p. 43234.

U.S. EPA, 1979. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020, U.S. EPA-EMSL, Cincinnati, Ohio.

ATTACHMENT A

GENERAL SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS

Sample Type and Concentration		Container[1]	Sample Size	Preservation[2]	Holding Time[2]
WATER					
Organics (GC&GC/MS)	VOC Low	Borosilicate glass	2 x 40 mL	Cool to 4°C HCl to ≤ 2	14 days[9]
	Extractables (Low SVOCs and pesticide/PCBs)	Amber glass	2x2 L or 4x1 L	Cool to 4°C	7 days to extraction; 40 days after extraction
	Extractables (Medium SVOCs and pesticide/PCBs)	Amber glass	2x2 L or 4x1 L	None	7 days to extraction; 40 days after extraction
Inorganics	Metals Low	High-density polyethylene	1 L	HNO_3 to pH ≤2	6 months (Hg-28 days)
	Medium	Wide-mouth glass	16 oz.	None	6 months
	Cyanide Low	High-density polyethylene	1 L	NaOH to pH>12	14 days
	Cyanide Medium	Wide-mouth glass	16 oz.	None	14 days
Organic/ Inorganic	High Hazard	Wide-mouth glass	8 oz.	None	14 days
SOIL					
Organics (GC&GC/MS)	VOC	Wide-mouth glass with teflon liner	2 x 4 oz.	Cool to 4°C	14 days
	Extractables (Low SVOCs and pesticides/PCBs)	Wide-mouth glass	8 oz.	Cool to 4°C	14 days to extraction; 40 days after extraction
	Extractables (Medium SVOCs and pesticides/PCBs)	Wide-mouth glass	8 oz.	Cool to 4°C	14 days to extraction; 40 days after extraction
Inorganics	Low/Medium	Wide-mouth glass	8 oz.	Cool to 4°C	6 months (Hg - 28 days) Cyanide (14 days)
Organic/ Inorganic	High Hazard	Wide-mouth glass	8 oz.	None	NA
Dioxin/Furan	All	Wide-mouth glass	4 oz.	None	7 days until extraction; 40 days after extraction
TCLP	All	Wide-mouth glass	8 oz.	None	7 days until preparation; analysis as per fraction
AIR					
Volatile Organics	Low/Medium	Charcoal tube – 7 cm long, 6 mm OD, 4 mm ID	100 L air	Cool to 4°C	5 days recommended

(1) All glass containers should have Teflon cap liners or septa.
(2) See Attachment E. Preservation and maximum holding time allowances per 40 CFR 136.

ATTACHMENT B

ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter Number/Name	Container[1]	Preservation[2][3]	Maximum Holding Time[4]
INORGANIC TESTS:			
Acidity	P, G	Cool, 4°C	14 days
Alkalinity	P, G	Cool, 4°C	14 days
Ammonia - Nitrogen	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Biochemical Oxygen Demand (BOD)	P, G	Cool, 4°C	48 hours
Bromide	P, G	None required	28 days
Chemical Oxygen Demand (COD)	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Chloride	P, G	None required	28 days
Chlorine, Total Residual	P, G	None required	Analyze immediately
Color	P, G	Cool, 4°C	48 hours
Cyanide, Total and Amenable to Chlorination	P, G	Cool, 4°C; NaOH to pH 12; 0.6 g ascorbic acid[5]	14 days[6]
Fluoride	P	None required	28 days
Hardness	P, G	HNO_3 to pH 2; H_2SO_4 to pH 2	6 months
Total Kjeldahl and Organic Nitrogen	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Nitrate - Nitrogen	P, G	None required	48 hours
Nitrate-Nitrite - Nitrogen	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Nitrite - Nitrogen	P, G	Cool, 4°C	48 hours
Oil & Grease	G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Total Organic Carbon (TOC)	P, G	Cool, 4°C; HCl or H_2SO_4 to pH 2	28 days
Orthophosphate	P, G	Filter immediately; Cool, 4°C	48 hours
Oxygen, Dissolved-Probe	G Bottle & top	None required	Analyze immediately
Oxygen, Dissolved-Winkler	G Bottle & top	Fix on site and store in dark	8 hours
Phenols	G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Phosphorus, Total	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Residue, Total	P, G	Cool, 4°C	7 days
Residue, Filterable (TDS)	P, G	Cool, 4°C	7 days
Residue, Nonfilterable (TSS)	P, G	Cool, 4°C	7 days
Residue, Settleable	P, G	Cool, 4°C	48 hours
Residue, Volatile (Ash Content)	P, G	Cool, 4°C	7 days
Silica	P	Cool, 4°C	28 days
Specific Conductance	P, G	Cool, 4°C	28 days
Sulfate	P, G	Cool, 4°C	28 days

ATTACHMENT B
ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES
PAGE TWO

Parameter Number/Name	Container[1]	Preservation[2][3]	Maximum Holding Time[4]
INORGANIC TESTS (Cont'd):			
Sulfide	P, G	Cool, 4°C; add zinc acetate plus sodium hydroxide to pH 9	7 days
Sulfite	P, G	None required	Analyze immediately
Turbidity	P, G	Cool, 4°C	48 hours
METALS:[7]			
Chromium VI (Hexachrome)	P, G	Cool, 4°C	24 hours
Mercury (Hg)	P, G	HNO_3 to pH 2	28 days
Metals, except Chromium VI and Mercury	P, G	HNO_3 to pH 2	6 months
ORGANIC TESTS:[8]			
Purgeable Halocarbons	G, Teflon-lined septum	Cool, 4°C; 0.008% $Na_2S_2O_3$[5]	14 days
Purgeable Aromatic Hydrocarbons	G, Teflon-lined septum	Cool, 4°C; 0.008% $Na_2S_2O_3$[5] HCl to pH 2 [9]	14 days
Acrolein and Acrylonitrile	G, Teflon-lined septum	Cool, 4°C; 0.008% $Na_2S_2O_3$[5] adjust pH to 4-5 [10]	14 days
Phenols[11]	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$[5]	7 days until extraction; 40 days after extraction
Benzidines[11], [12]	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$[5]	7 days until extraction[13]
Phthalate esters[11]	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction
Nitrosamines[11], [14]	G, Teflon-lined cap	Cool, 4°C; store in dark; 0.008% $Na_2S_2O_3$[5]	7 days until extraction; 40 days after extraction
PCBs[11]	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction
Nitroaromatics & Isophorone[11]	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$[5]; store in dark	7 days until extraction; 40 days after extraction
Polynuclear Aromatic Hydrocarbons (PAHs)[11],[14]	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$[5]; store in dark	7 days until extraction; 40 days after extraction
Haloethers[11]	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$[5]	7 days until extraction; 40 days after extraction
Dioxin/Furan (TCDD/TCDF)[11]	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$[5]	7 days until extraction; 40 days after extraction

ATTACHMENT B
ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES
PAGE THREE

Parameter Number/Name	Container(1)	Preservation(2)(3)	Maximum Holding Time(4)
RADIOLOGICAL TESTS:			
1-5 Alpha, beta and radium	P, G	HNO_3 to pH 2	6 months

(1) Polyethylene (P): generally 500 ml or Glass (G): generally 1L.
(2) Sample preservation should be performed immediately upon sample collection. For composite chemical samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
(3) When any sample is to be shipped by common carrier or sent through the United States Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172).
(4) Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer periods, and has received a variance from the Regional Administrator.
(5) Should only be used in the presence of residual chlorine.
(6) Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before pH adjustments are made to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.
(7) Samples should be filtered immediately on site before adding preservative for dissolved metals.
(8) Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.
(9) Sample receiving no pH adjustment must be analyzed within 7 days of sampling.
(10) The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.
(11) When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9; samples preserved in this manner may be held for 7 days before extraction and for 40 days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re: the requirement for thiosulfate reduction of residual chlorine) and footnotes 12, 13 (re: the analysis of benzidine).
(12) If 1,2-diphenylthydrazine is likely to be present, adjust the pH of the sample to 4.0±0.2 to prevent rearrangement to benzidine.
(13) Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.
(14) For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.
(15) The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

ATTACHMENT C

DOT HAZARDOUS MATERIAL CLASSIFICATION (49 CFR 173.2a)

1. Radioactive material (except a limited quantity)
2. Division 2.3, Poisonous Gases
3. Division 2.1, Flammable Gas
4. Division 2.2, Nonflammable gas
5. Division 6.1, Poisonous Liquids, Packing Group 1 (poison by inhalation only)
6. Division 4.2, Pyrophoric Material
7. Division 4.1, Self-Reactive Material
8. Class 3, Flammable Liquids*
9. Class 8, Corrosive Material
10. Division 4.1, Flammable Solid*
11. Division 4.2, Spontaneously Combustible Materials*
12. Division 4.3, Dangerous When Wet Materials*
13. Division 5.1, Oxidizers*
14. Division 6.1, Poisonous Liquids or Solids (other than Packing Group 1)*
15. Combustible liquid
16. Class 9, Miscellaneous Hazardous Materials

* If a material has or meets the criteria for more than one hazard class, use the precedence of hazardous table on the following page for Classes 3 and 8 and Divisions 4.1, 4.2, 4.3, 5.1, and 6.1. The following table ranks those materials that meet the definition of Classes 3 and 8 and Divisions 4.1, 4.2, 4.3, 5.1, and 6.1.

ATTACHMENT C (Continued)

PRECEDENCE OF HAZARD TABLE

(Hazard Class and Packing Group)

Class	Packing Group	4.2	4.3	5.1 I[a]	5.1 II[a]	5.1 III[a]	6.1 I (Dermal)	6.1 I (Oral)	6.1 II	6.1 III	8 I (Liquid)	8 I (Solid)	8 II (Liquid)	8 II (Solid)	8 III (Liquid)	8 III (Solid)
3	I						3	3	3	3	3	[c]	3	[c]	3	[c]
3	II						3	3	3	3	8	[c]	3	[c]	3	[c]
3	III						6.1	6.1	6.1	3[d]	8	[c]	8	[c]	3	[c]
4.1	II[b]	4.2	4.3	5.1	4.1	4.1	6.1	6.1	4.1	4.1	[c]	8	[c]	4.1	[c]	4.1
4.1	III[b]	4.2	4.3	5.1	4.1	4.1	6.1	6.1	6.1	4.1	[c]	8	[c]	8	[c]	4.1
4.2	II		4.3	5.1	4.2	4.2	6.1	6.1	4.2	4.2	[c]	8	[c]	4.2	[c]	4.2
4.2	III		4.3	5.1	4.2	4.2	6.1	6.1	6.1	4.2	[c]	8	[c]	8	[c]	4.2
4.3	I			5.1	4.3	4.3	6.1	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
4.3	II			5.1	4.3	4.3	6.1	4.3	4.3	4.3	8	8	8	4.3	4.3	4.3
4.3	III			5.1	4.3	4.3	6.1	6.1	6.1	4.3	8	8	8	8	4.3	4.3
5.1	I[a]						5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
5.1	II[a]						6.1	5.1	5.1	5.1	8	8	8	5.1	5.1	5.1
5.1	III[a]						6.1	6.1	6.1	5.1	8	8	8	8	5.1	5.1
6.1	I, Dermal										8	6.1	6.1	6.1	6.1	6.1
6.1	I, Oral										8	6.1	6.1	6.1	6.1	6.1
6.1	II, Inhalation										8	6.1	6.1	6.1	6.1	6.1
6.1	II, Dermal										8	6.1	8	6.1	6.1	6.1
6.1	II, Oral										8	8	8	6.1	6.1	6.1
6.1	III										8	8	8	8	8	8

[a] There are at present no established criteria for determining Packing Groups for liquids in Division 5.1. At present, the degree of hazard is to be assessed by analogy with listed substances, allocating the substances to Packing Group I, Great; Group II, Medium; or Group III, Minor Danger.

[b] Substances of Division 4.1 other than self-reactive substances.

[c] Denotes an impossible combination.

[d] For pesticides only, where a material has the hazards of Class 3, Packing Group III, and Division 6.1, Packing Group III, the primary hazard is Division 6.1, Packing Group III.

ATTACHMENT D

GUIDE FOR HAZARDOUS MATERIALS SHIPPERS

USE OF GUIDE - This guide is presented as an aid to shippers of hazardous materials. It does not contain or refer to all of the DOT requirements for shipping hazardous materials. For specific details, refer to all of the DOT requirements for shipping hazardous materials, as provided in the Code of Federal Regulations (CFR), Title 49, Transportation, Parts 100-199.

The following is offered as a step-by-step procedure to aid in compliance with the applicable DOT regulations.

STEP 1 - DETERMINE THE PROPER SHIPPING NAME. The shipper must determine the proper shipping name of the materials as listed in the Hazardous Materials Table, 49 CFR 172.101, Column (2).

STEP 2 - DETERMINE THE HAZARD CLASS OR CLASSES.

a. Refer to the Table, 49 CFR 172.101, Column (3), and locate the hazard class of the material.
b. If more than one class is shown for the proper shipping name, determine the proper class by definition.
c. If the materials have more than one hazard, classify the material based on the order of hazards in 49 CFR 173.2.

STEP 3 - SELECT THE PROPER IDENTIFICATION NUMBERS.

a. Refer to the Table, 49 CFR 172.101, Column (3a), and select the Identification Number (ID) that corresponds to the proper shipping name and hazard class.
b. Enter the ID number(s) on the shipping papers and display them, as required, on packagings, placards and/or orange panels.

STEP 4 - DETERMINE THE MODE(S) OF TRANSPORT TO ULTIMATE DESTINATION.

a. As a shipper, you must assure yourself that the shipment complies with various modal requirements.
b. The modal requirements may affect the following: (1) Packaging; (2) Quantity per Package; (3) Marking; (4) Labeling; (5) Shipping Papers; and (6) Certification.

STEP 5 - SELECT THE PROPER LABEL(S) AND APPLY AS REQUIRED.

a. Refer to the Table, 49 CFR 172.101, Column (4) for required labels.
b. For details on labeling refer to (1) Additional Labels, 49 CFR 172.402; (2) Placement of Labels, 49 CFR 172.406; (3) Packagings (Mixed or Consolidated), 49 CFR 172.404(a) and (h); (4) Packages Containing Samples, 49 CFR 172.402(h); (5) Radioactive Materials, 49 CFR 172.403; and (6) Authorized Label Modifications, 49 CFR 172.405.

STEP 6 - DETERMINE AND SELECT THE PROPER PACKAGES.

a. Refer to the Table, 49 CFR 172.101, Column (5a) for exceptions and Column (5b) for specification packagings. Consider the following when selecting an authorized package: Quantity per Package; Cushioning Material, if required; Proper Closure and Reinforcement; Proper Pressure; Outage; etc., as required.
b. If packaged by a prior shipper, make sure the packaging is correct and in proper condition for transportation.

ATTACHMENT D (Continued)
GUIDE FOR HAZARDOUS MATERIALS SHIPPERS

STEP 7 - MARK THE PACKAGING (INCLUDING OVERPACKS).

a. Apply the required markings (49 CFR 172.300); Proper shipping name and ID number, when required (49 CFR 172.301); Name and address of Consignee or Consignor (49 CFR 172.306).
b. For details and other required markings, see 49 CFR 172.300 through 172.338.

STEP 8 - PREPARE THE SHIPPING PAPERS.

a. The basic requirements for preparing shipping papers include Proper Shipping Name; Hazard Class; ID Number; Total Quantity; Shipper's Certification; and Emergency Response Telephone Number.
b. Make all entries on the shipping papers using the information required and in proper sequence (49 CFR 172.202).

STEP 9 - CERTIFICATION.

a. Each shipper must certify by printing (manually or mechanically) on the shipping papers that the materials being offered for shipment are properly classified, described, packaged, marked and labeled, and in proper condition for transportation according to the applicable DOT Regulations (49 CFR 172.202).

STEP 10 - LOADING, BLOCKING, AND BRACING. When hazardous materials are loaded into the transport vehicle or freight container, each package must be loaded, blocked, and braced in accordance with the requirements for mode of transport.

a. If the shipper loads the freight container or transport vehicle, the shipper is responsible for the proper loading, blocking, and bracing of the materials.
b. If the carrier does the loading, the carrier is responsible.

STEP 11 - DETERMINE THE PROPER PLACARD(S). Each person who offers hazardous materials for transportation must determine that the placarding requirements have been met.

a. For Highway, unless the vehicle is already correctly placarded, the shipper must provide the required placard(s) and required ID number(s) (49 CFR 172.506).
b. For Rail, if loaded by the shipper, the shipper must placard the rail car if placards are required (49 CFR 172.508).
c. For Air and Water shipments, the shipper has the responsibility to apply the proper placards.

STEP 12 - HAZARDOUS WASTE/HAZARDOUS SUBSTANCE.

a. If the material is classed as a hazardous waste or hazardous substance, most of the above steps will be applicable.
b. Pertinent Environmental Protection Agency regulations are found in the Code of Federal Regulations, Title 40, Part 262.

As a final check and before offering the shipment for transportation, visually inspect your shipment. The shipper should ensure that emergency response information is on the vehicle for transportation of hazardous materials.

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Revised March 1995.

ATTACHMENT E

HAZARDOUS MATERIALS SHIPPING CHECK LIST

PACKAGING

1. Check DOT 173.24 for appropriate type of package for hazardous substance.

2. Check for container integrity, especially the closure.

3. Check for sufficient absorbent material in package.

4. Check for sample tags and log sheets for each sample and for chain-of-custody record.

SHIPPING PAPERS

1. Check that entries contain only approved DOT abbreviations.

2. Check that entries are in English.

3. Check that hazardous material entries are specially marked to differentiate them from any nonhazardous materials being sent using same shipping paper.

4. Be careful that all hazardous classes are shown for multiclass materials.

5. Check total amounts by weight, quantity, or other measures used.

6. Check that any limited-quantity exemptions are so designated on the shipping paper.

7. Check that certification is signed by shipper.

8. Make certain driver signs for shipment.

RCRA MANIFEST

1. Check that approved state/federal manifests are prepared.

2. Check that transporter has the following: valid EPA identification number, valid driver's license, valid vehicle registration, insurance protection, and proper DOT labels for materials being shipped.

3. Check that destination address is correct.

4. Check that driver knows where shipment is going.

5. Check that the driver is aware of emergency procedures for spills and accidents.

6. Make certain driver signs for shipment.

7. Make certain one copy of executed manifest and shipping document is retained by shipper.

ATTACHMENT F

DOT SEGREGATION AND SEPARATION CHART

Class or Division	Notes	1.1-1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3 gas Zone A*	2.3 gas Zone B*	3	4.1	4.2	4.3	5.1	5.2	6.1 liquids PG-I Zone A*	7	8 liquids only
Explosives .... 1.1 and 1.2	A	*	*	*	*	*	X	X	X	X	X	X	X	X	X	X	X	X	X
Explosives 1.3		*	*	*	*	*	X		X	X	X		X	X	X	X	X		X
Explosives 1.4		*	*	*	*	*	O		O	O	O		O				O		O
Very insensitive explosives 1.5	A	*	*	*	*	*	X	X	X	X	X	X	X	X	X	X	X	X	X
Extremely insensitive explosives 1.6		*	*	*	*	*													
Flammable gases 2.1		X	X	O	X				X	O							O	O	
Non-toxic, non-flammable gases 2.2		X			X														
Poisonous gas - Zone A** 2.3		X	X	O	X		X				X	X	X	X	X	X			X
Poisonous gas - Zone B** 2.3		X	X	O	X		O				O	O	O	O	O	O			O
Flammable liquids 3		X	X	O	X				X	O					O		X		
Flammable solids 4.1		X			X				X	O							X		O
Spontaneously combustible materials 4.2		X	X	O	X				X	O							X		X
Dangerous-when-wet materials 4.3		X	X		X				X	O							X		O
Oxidizers 5.1	A	X	X		X				X	O	O						X		O
Organic peroxides 5.2		X	X		X				X	O							X		O
Poisonous liquids PG I - Zone A** .. 6.1		X	X	O	X		O				X	X	X	X	X	X			X
Radioactive materials 7		X			X		O												
Corrosive liquids 8		X	X	O	X				X	O		O	X	O	O	O	X		

No entry means that the materials are compatible (have no restrictions).

X These materials may not be loaded, transported, or stored together in the same vehicle or facility.
O The materials may not be loaded, transported, or stored together in the same vehicle or facility unless they are separated for 4 feet on all sides.
* Check the explosives compatibility chart in 49 CFR 179.848(f).
A Ammonium nitrate fertilizers may be stored with Division 1.1 materials.
** Denotes inhalation hazardous for poisons; consult field team leader or project manager if you encounter a material in this class before shipment.

ATTACHMENT G
LITHIUM BATTERY SHIPPING PAPERS

3224637861

Two completed and signed copies of this Declaration must be handed to the operator.

WARNING

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.

TRANSPORT DETAILS

This shipment is within the limitations prescribed for: *(delete non applicable)*	Airport of Departure
~~PASSENGER AND CARGO AIRCRAFT~~ / CARGO AIRCRAFT ONLY	

Airport of Destination: 19CYS

Shipment type: *(delete non-applicable)* NON-RADIOACTIVE / ~~RADIOACTIVE~~

NATURE AND QUANTITY OF DANGEROUS GOODS

Dangerous Goods Identification						
Proper Shipping Name	Class or Division	UN or ID No.	Subsidiary Risk	Quantity and type of packing	Packing Inst.	Authorization
LITHIUM BATTERIES CONTAINED IN EQUIPMENT	9	UN3091		1 PLASTIC BOX X 55 GRAMS	912 II	PER CA-9206009

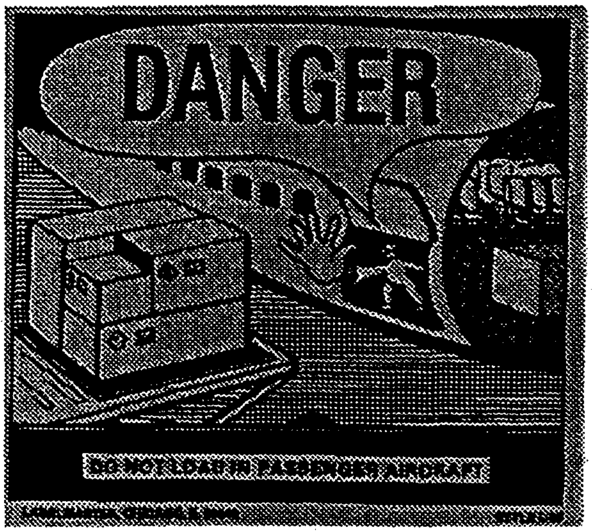
Additional Handling Information

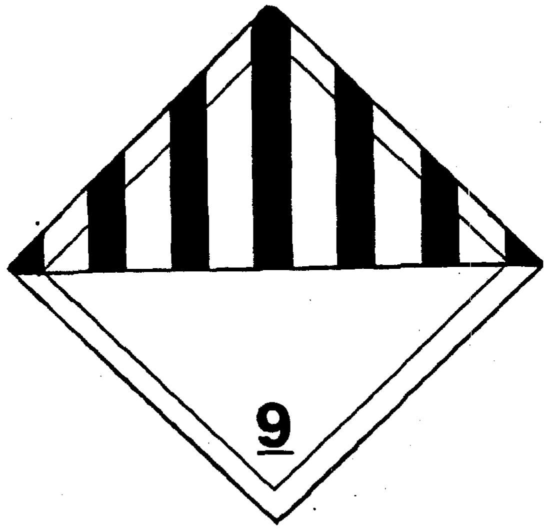
1 HERMIT SERIES DATALOGGER X 55 GRAMS (11 GRAMS/CELL)

I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in the proper condition for transport by air according to the applicable International and National Government Regulations.	Name/Title of Signatory Place and Date
Emergency Telephone Number (Required for US Origin or Destination Shipments) 800-535-5053	Signature *(see warning above)*

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS, OR TREATMENT.

ATTACHMENT G (CONTINUED)
LITHIUM BATTERY SHIPPING PAPERS





LITHIUM BATTERIES CONTAINED IN EQUIPMENT.
UN-3091.
SHIPPED UNDER CA-9206009

BROWN & ROOT ENVIRONMENTAL	STANDARD OPERATING PROCEDURES	Number: SA-6.3	Page: 1 of 32
		Effective Date: 03/01/96	Revision: 0
		Applicability: B&R Environmental, NE	
		Prepared: Earth Sciences Department	
Subject: FIELD DOCUMENTATION		Approved: D. Senovich	

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to identify and designate the field data record forms, logs and reports generally initiated and maintained for documenting Brown & Root Environmental field activities.

2.0 SCOPE

Documents presented within this procedure (or equivalents) shall be used for all Brown & Root Environmental field activities, as applicable. Other or additional documents may be required by specific client contracts.

3.0 GLOSSARY

None

4.0 RESPONSIBILITIES

Project Manager - The Project Manager is responsible for obtaining hardbound, controlled-distribution logbooks (from the appropriate source), as needed. In addition, the Project Manager is responsible for placing all forms used in site activities (i.e., records, field reports, and upon the completion of field work, the site logbook) in the project's central file.

Field Operations Leader (FOL) - The Field Operations Leader is responsible for ensuring that the site logbook, notebooks, and all appropriate forms and field reports illustrated in this guideline (and any additional forms required by the contract) are correctly used, accurately filled out, and completed in the required time-frame.

5.0 PROCEDURES

5.1 Site Logbook

5.1.1 General

The site logbook is a hard-bound, paginated controlled-distribution record book in which all major onsite activities are documented. At a minimum, the following activities/events shall be recorded (daily) in the site logbook:

- All field personnel present
- Arrival/departure of site visitors
- Arrival/departure of equipment
- Start or completion of borehole/trench/monitoring well installation or sampling activities
- Daily onsite activities performed each day
- Sample pickup information
- Health and Safety issues (level of protection observed, etc.)
- Weather conditions

A site logbook shall be maintained for each project. The site logbook shall be initiated at the start of the first onsite activity (e.g., site visit or initial reconnaissance survey). Entries are to be made for every day that onsite activities take place which involve Brown & Root Environmental or subcontractor personnel. Upon completion of the fieldwork, the site logbook must become part of the project's central file.

The following information must be recorded on the cover of each site logbook:

- Project name
- Brown & Root Environmental project number
- Sequential book number
- Start date
- End date

Information recorded daily in the site logbook need not be duplicated in other field notebooks (see Section 5.2), but must summarize the contents of these other notebooks and refer to specific page locations in these notebooks for detailed information (where applicable). An example of a typical site logbook entry is shown in Attachment A.

If measurements are made at any location, the measurements and equipment used must either be recorded in the site logbook or reference must be made to the site notebook in which the measurements are recorded (see Attachment A).

All logbook, notebook, and log sheet entries shall be made in indelible ink (black pen is preferred). No erasures are permitted. If an incorrect entry is made, the data shall be crossed out with a single strike mark, and initialed and dated. At the completion of entries by any individual, the logbook pages used must be signed and dated. The site logbook must also be signed by the Field Operations Leader at the end of each day.

5.1.2 Photographs

When movies, slides, or photographs are taken of a site or any monitoring location, they must be numbered sequentially to correspond to logbook entries. The name of the photographer, date, time, site location, site description, and weather conditions must be entered in the logbook as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, special lenses, films, filters, and other image-enhancement techniques must be noted in the logbook. If possible, such techniques shall be avoided, since they can adversely affect the admissibility of photographs as evidence. Chain-of-custody procedures depend upon the subject matter, type of film, and the processing it requires. Film used for aerial photography, confidential information, or criminal investigation require chain-of-custody procedures. Adequate logbook notation and receipts must be compiled to account for routine film processing. Once processed, the slides of photographic prints shall be consecutively numbered and labeled according to the logbook descriptions. The site photographs and associated negatives must be docketed into the project's central file.

5.2 Site Notebooks

Key field team personnel may maintain a separate dedicated notebook to document the pertinent field activities conducted directly under their supervision. For example, on large projects with multiple investigative sites and varying operating conditions, the Health and Safety Officer may elect to maintain a separate site notebook. Where several drill rigs are in operation simultaneously, each site geologist assigned to oversee a rig must maintain a site notebook.

5.3 Sample Forms

A summary of the forms illustrated in this procedure is shown as the listing of Attachments in the Table of Contents for this SOP. Forms may be altered or revised for project-specific needs contingent upon client approval. Care must be taken to ensure that all essential information can be documented. Guidelines for completing these forms can be found in the related sampling SOP.

5.3.1 Sample Collection, Labeling, Shipment and Request for Analysis

5.3.1.1 Sample Log Sheet

Sample Log Sheets are used to record specified types of data while sampling. Attachments B-1 to B-4 are examples of Sample Log Sheets. The data recorded on these sheets are useful in describing the waste source and sample as well as pointing out any problems encountered during sampling. A log sheet must be completed for each sample obtained, including field quality control (QC) samples.

5.3.1.2 Sample Label

A typical sample label is illustrated in Attachment B-5. Adhesive labels must be completed and applied to every sample container. Sample labels can usually be obtained from the appropriate Program source or are supplied from the laboratory subcontractor.

5.3.1.3 Chain-of-Custody Record Form

The Chain-of-Custody (COC) Record is a multi-part form that is initiated as samples are acquired and accompanies a sample (or group of samples) as they are transferred from person to person. This form must be used for any samples collected for chemical or geotechnical analysis whether the analyses are performed on site or off site. One part of the completed COC form is retained by the field crew while the other two or three portions are sent to the laboratory. The original (top, signed copy) and extra carbonless copies of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the first cooler. The COC form should then state how many coolers are included with that shipment. An example of a Chain-of-Custody Record form is provided as Attachment B-6. A supply of these forms are purchased and stocked by the field department of the various Brown & Root Environmental offices. Alternately, COC forms supplied by the laboratory may be used. Once the samples are received at the laboratory, the sample cooler and contents are checked and any problems are noted on the enclosed COC form (any discrepancies between the sample labels and COC form and any other problems that are noted are resolved through communication between the laboratory point-of-contact and the Brown & Root Environmental Project Manager). The COC form is signed and one of the remaining two parts are retained by the laboratory while the last part becomes part of the samples' corresponding analytical data package. Internal laboratory chain-of-custody procedures are documented in the Laboratory Quality Assurance Plan (LQAP).

5.3.1.4 Chain-of-Custody Seal

Attachment B-7 is an example of a custody seal. The Custody seal is also an adhesive-backed label. It is part of a chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field and sealed in coolers for transit to the laboratory. The COC seals are signed and dated by the samplers and affixed across the opening edges of each cooler containing environmental samples. COC seals may be available from the laboratory; these seals may also be purchased from a supplier.

5.3.2 Geohydrological and Geotechnical Forms

5.3.2.1 Groundwater Level Measurement Sheet

A groundwater level measurement sheet, shown in Attachment C-1 must be filled out for each round of water level measurements made at a site.

5.3.2.2 Data Sheet for Pumping Test

During the performance of a pumping test (or an in-situ hydraulic conductivity test), a large amount of data must be recorded, often within a short time period. The pumping test data sheet (Attachment C-2) facilitates this task by standardizing the data collection format, and allowing the time interval for collection to be laid out in advance.

5.3.2.3 Packer Test Report Form

A packer test report form shown in Attachment C-3 must be completed for each well upon which a packer test is conducted following well installation.

5.3.2.4 Summary Log of Boring

During the progress of each boring, a log of the materials encountered, operation and driving of casing, and location of samples must be kept. The Summary Log of Boring (Attachment C-4) is used for this purpose and must be completed for each soil boring performed. In addition, if volatile organics are monitored on cores, samples or cuttings from the borehole (using HNU or OVA detectors), these results must be entered on the boring log (under the "Remarks" column) at the appropriate depth. The "Remarks" column can also be used to subsequently enter the laboratory sample number and the concentration of a few key analytical results. This feature allows direct comparison of contaminant concentrations with soil characteristics.

5.3.2.5 Monitoring Well Construction Details Form

A Monitoring Well Construction Details Form must be completed for every monitoring well piezometer or temporary well point installed. This form contains specific information on length and type of well riser pipe and screen, backfill, filter pack, annular seal and grout characteristics, and surface seal characteristics. This information is important in evaluating the performance of the monitoring well, particularly in areas where water levels show temporal variation, or where there are multiple (immiscible) phases of contaminants. Depending on the type of monitoring well (in overburden or bedrock), different forms are used (see Attachments C-5 through C-9). Similar forms are used for flush-mount well completions. The Monitoring Well Construction Details Form is not a controlled document.

5.3.2.6 Test Pit Log

When a test pit or trench is constructed for investigative or sampling purposes, a Test Pit Log (Attachment C-10) must be filled out by the responsible field geologist or sampling technician.

5.3.3 Equipment Calibration and Maintenance Form

The calibration or standardization of monitoring, measuring or test equipment is necessary to assure the proper operation and response of the equipment, to document the accuracy, precision or sensitivity of the measurement, and determine if correction should be applied to the readings. Some items of equipment require frequent calibration, others infrequent. Some are calibrated by the manufacturer, others by the user.

Each instrument requiring calibration has its own Equipment Calibration Log (Attachment D) which documents that the manufacturer's instructions were followed for calibration of the equipment, including frequency and type of standard or calibration device. An Equipment Calibration Log must be maintained for each electronic measuring device used in the field; entries must be made for each day the equipment is used.

5.4 Field Reports

The primary means of recording onsite activities is the site logbook. Other field notebooks may also be maintained. These logbooks and notebooks (and supporting forms) contain detailed information required for data interpretation or documentation, but are not easily useful for tracking and reporting of progress. Furthermore, the field logbook/notebooks remain onsite for extended periods of time and are thus not accessible for timely review by project management.

5.4.1 Weekly Status Reports

To facilitate timely review by project management, Xeroxed copies of logbook/notebook entries may be made for internal use. To provide timely oversight of onsite contractors, Daily Activities Reports are completed and submitted as described below.

It should be noted that in addition to the summaries described herein, other summary reports may also be contractually required.

5.4.2 Daily Activities Report

5.4.2.1 Description

The Daily Activities Report (DAR) documents the activities and progress for each day's field work. This report must be filled out on a daily basis whenever there are drilling, test pitting, well construction, or other related activities occurring which involve subcontractor personnel. These sheets summarize the work performed and form the basis of payment to subcontractors (Attachment E is an example of a Daily Activities Report).

5.4.2.2 Responsibilities

It is the responsibility of the rig geologist to complete the DAR and obtain the driller's signature acknowledging that the times and quantities of material entered are correct.

5.4.2.3 Submittal and Approval

At the end of the shift, the rig geologist must submit the Daily Activities Report to the Field Operations Leader (FOL) for review and filing. The Daily Activities Report is not a formal report and thus requires no further approval. The DAR reports are retained by the FOL for use in preparing the site logbook and in preparing weekly status reports for submission to the Project Manager.

6.0 ATTACHMENTS

Attachment A	TYPICAL SITE LOGBOOK ENTRY
Attachment B-1	EXAMPLE GROUNDWATER SAMPLE LOG SHEET
Attachment B-2	EXAMPLE SURFACE WATER SAMPLE LOG SHEET
Attachment B-3	EXAMPLE SOIL/SEDIMENT SAMPLE LOG SHEET
Attachment B-4	CONTAINER SAMPLE LOG SHEET FORM
Attachment B-5	SAMPLE LABEL
Attachment B-6	CHAIN-OF-CUSTODY RECORD FORM
Attachment B-7	CHAIN-OF-CUSTODY SEAL
Attachment C-1	EXAMPLE GROUNDWATER LEVEL MEASUREMENT SHEET
Attachment C-2	EXAMPLE PUMPING TEST DATA SHEET
Attachment C-3	PACKER TEST REPORT FORM
Attachment C-4	EXAMPLE BORING LOG
Attachment C-5	EXAMPLE OVERBURDEN MONITORING WELL SHEET
Attachment C-5A	EXAMPLE OVERBURDEN MONITORING WELL SHEET (FLUSHMOUNT)
Attachment C-6	EXAMPLE CONFINING LAYER MONITORING WELL SHEET
Attachment C-7	EXAMPLE BEDROCK MONITORING WELL SHEET - OPEN HOLE WELL
Attachment C-8	EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK
Attachment C-8A	EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK (FLUSHMOUNT)
Attachment C-9	EXAMPLE TEST PIT LOG
Attachment D	EXAMPLE EQUIPMENT CALIBRATION LOG
Attachment E	EXAMPLE DAILY ACTIVITIES RECORD
Attachment F	FIELD TRIP SUMMARY REPORT

ATTACHMENT A
TYPICAL SITE LOGBOOK ENTRY

START TIME: ____________________ DATE: ____________________

SITE LEADER: ____
PERSONNEL:

BROWN & ROOT ENV.	DRILLER	EPA
______________	______________	______________
______________	______________	______________
______________	______________	______________

WEATHER: Clear, 68°F, 2-5 mph wind from SE

ACTIVITIES:

1. Steam jenney and fire hoses were set up.
2. Drilling activities at well ____ resumes. Rig geologist was ____________. See Geologist's Notebook, No. 1, page 29-30, for details of drilling activity. Sample No. 123-21-S4 collected; see sample logbook, page 42. Drilling activities completed at 11:50 and a 4-inch stainless steel well installed. See Geologist's Notebook, No. 1, page 31, and well construction details for well ______.
3. Drilling rig No. 2 steam-cleaned at decontamination pit. Then set up at location of well _______.
4. Well _____ drilled. Rig geologist was _________________. See Geologist's Notebook, No. 2, page ____ for details of drilling activities. Sample numbers 123-22-S1, 123-22-S2, and 123-22-S3 collected; see sample logbook, pages 43, 44, and 45.
5. Well _____ was developed. Seven 55-gallon drums were filled in the flushing stage. The well was then pumped using the pitcher pump for 1 hour. At the end of the hour, water pumped from well was "sand free."
6. EPA remedial project manger arrives on site at 14:25 hours.
7. Large dump truck arrives at 14:45 and is steam-cleaned. Backhoe and dump truck set up over test pit ________.
8. Test pit ______ dug with cuttings placed in dump truck. Rig geologist was ____________. See Geologist's Notebook, No. 1, page 32, for details of test pit activities. Test pit subsequently filled. No samples taken for chemical analysis. Due to shallow groundwater table, filling in of test pit ___ resulted in a very soft and wet area. A mound was developed and the area roped off.
9. Express carrier picked up samples (see Sample Logbook, pages 42 through 45) at 17:50 hours. Site activities terminated at 18:22 hours. All personnel off site, gate locked.

____
Field Operations Leader

ATTACHMENT B-1
EXAMPLE GROUNDWATER SAMPLE LOG SHEET

GROUNDWATER

SAMPLE LOG SHEET

Page ____ of ____

Project Site Name: ____________________ Sample ID No.: ____________________

Project No.: ____________________ Sample Location: ____________________

☐ Domestic Well Data

☐ Monitoring Well Data

☐ Other Well Type: ____________________

☐ QA Sample Type: ____________________

Sampled By: ____________________

C.O.C. No.: ____________________

Sampling Data

Date: / Time: / Method:	pH	S.C.	Temp. (°C)	Turbidity	Color	TBD	TBD	TBD

Purge Data

	Volume	pH	S.C.	Temp. (°C)	Turbidity	Color	TBD	TBD
Date: / Method:	Initial							
Monitor Reading (ppm):	1							
Well Casing Dia. & Material Type:	2							
	3							
Total Well Depth (TD):	4							
Static Water Level (WL):	5							
TD-WL (ft.) =								
One Casing Volume: (gal/L)								
Start Purge (hrs.):								
End Purge (hrs.):								
Total Purge Time (min):								
Total Amount Purged (gal/L):								

Analysis	Preservative	Container Requirements	Collected (✓)

Observations/Notes:

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No:	

TBD: To Be Determined

ATTACHMENT B-2
EXAMPLE SURFACE WATER SAMPLING LOG SHEET

SURFACE WATER SAMPLING LOG SHEET

Page ____ of ____

Project Site Name: ____________ Sample ID No.: ____________

Project No.: ____________ Sample Location: ____________

☐ Spring ☐ Pond Sampled By: ____________
☐ Stream ☐ Lake
☐ Other ____________
☐ QA Sample Type: ____________ C.O.C. No.: ____________

Sample Data							
Date and Time			Method			Depth	
pH	S.C.	Temp. (°C)	Turbidity	Color	TBD	TBD	TBD

Analysis	Preservative	Container Requirements	Collected (✓)

Observations/Notes:

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	

TBD: To Be Determined

ATTACHMENT B-3
EXAMPLE SOIL/SEDIMENT SINGLE SAMPLE LOG SHEET

SOIL/SEDIMENT SINGLE SAMPLE LOG SHEET

Page ____ of ____

Project Site Name: ________________ Sample ID No.: ________________

Project No.: ________________ Sample Location: ________________

Sampled By: ________________

C.O.C. No.: ________________

- ☐ Surface Soil
- ☐ Subsurface Soil
- ☐ Sediment
- ☐ Other ________
- ☐ QA Sample Type: ________

Sample Method:

Depth Sampled:

Sample Date and Time:

Type of Sample
- ☐ Grab
- ☐ Composite
- ☐ Grab-Composite
- ☐ High Concentration
- ☐ Low Concentration

Composite Sample Data		
Sample	Time	Color/Description

Grab Sample Data	
Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)

Analysis	Container Requirements	Collected (✓)

Map:

Observations/Notes:

Circle if Applicable:

MS/MSD	Duplicate ID No:

Signature(s):

ATTACHMENT B-4
CONTAINER SAMPLE LOG SHEET FORM

Brown & Root Environmental

Page ___ of _

☐ Container Data

Case #: _______

By: ______________________________

Project Site Name: ______________________________ Project Site No. ______________________________

Brown & Root Env. Source No. ________________ Source Location: ______________________________

Container Source	Container Description
☐ Drum ☐ Bung Top ☐ Lever Lock ☐ Bolted Ring ☐ Other ____________ ☐ Bag/Sack ☐ Tank ☐ Other ____________	Color: ______________ Condition: ______________ Markings: ______________ Vol. of Contents: ______________ Other: ______________

Disposition of Sample	Sample Description		
☐ Container Sampled ☐ Container opened but not sampled. Reason: ________ ☐ Container not opened. Reason: ________			
	Layer 1	Layer 2	Layer 3
Phase	☐Sol. ☐Liq.	☐Sol. ☐Liq.	☐Sol. ☐Liq.
Color	________	________	________
Viscosity	☐L ☐M ☐H	☐L ☐M ☐H	☐L ☐M ☐H
% of Total Volume	________	________	________
Other	________	________	________

Monitor Reading:	Type of Sample
Sample Method:	☐ Low Concentration ☐ High Concentration ☐ Grab ☐ Composite ☐ Grab-composite

	Sample Identification	Organic	Inorganic
Sample Date & Time:			
Sampled by:			
Signature(s):			
	Date Shipped		
Analysis:	Time Shipped		
	Lab		
	Volume		

ATTACHMENT B-5

SAMPLE LABEL

Brown & Root Environmental PROJECT:______________________

STATION LOCATION: ______________________

DATE: ____/____/____ TIME: ________ hrs.

MEDIA: WATER ☐ SOIL ☐ SEDIMENT ☐ ________ ☐

CONCENTRATION: LOW ☐ MEDIUM ☐ HIGH ☐

TYPE: GRAB ☐ COMPOSITE ☐

ANALYSIS	PRESERVATION
VOA ☐ BNAs ☐	Cool to 4°C ☐
PCBs ☐ PESTICIDES ☐	HNO_3 to pH < 2 ☐
METALS: TOTAL ☐ DISSOLVED ☐	NaOH to pH > 12 ☐
CYANIDE ☐	________ ☐
________ ☐	

Sampled by: ______________________

Remarks:

ATTACHMENT B-6

CHAIN-OF-CUSTODY RECORD FORM
(Original is 8.5 x 11")

PROJECT NO.	PROJECT NAME													
SAMPLERS: *(Signature)*						NO. OF CONTAINERS							REMARKS
STA NO.	DATE	TIME			STATION LOCATION									

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks:	

ATTACHMENT B-7

CHAIN-OF-CUSTODY SEAL

CUSTODY SEAL Date ____________ Signature ____________	CUSTODY SEAL Date ____________ Signature ____________

ATTACHMENT C-1
EXAMPLE GROUNDWATER LEVEL MEASUREMENT SHEET

GROUNDWATER LEVEL MEASUREMENT SHEET

Page ___ of ___

PROJECT NAME: ____________________ LOCATION: ____________________
PROJECT NUMBER: ____________________ MEASURING DEVICE: ____________________
PERSONNEL: ____________________ ADJUSTMENT FACTOR: ____________________
DATE: ____________________ REMARKS: ____________________
WEATHER CONDITIONS: ____

Well or Piezometer Number	Time	Elevation of Reference Point (Feet)*	Water Level Indicator Reading (Feet)*	Groundwater Elevation (Feet)*	Comments

*Measurements to nearest 0.01 foot.

Signature(s): ____________________

ATTACHMENT C-2
EXAMPLE PUMPING TEST DATA SHEET

PUMPING TEST DATA SHEET

Page ___ of ___

PROJECT NAME: ______________________
PROJECT NUMBER: ______________________
PUMPING TEST: [ ]
TEST NUMBER: ______________________
METHOD OF MEASUREMENT: ______________
DATE(s): ______________________
STATIC H_2O LEVEL (ft) (SO) ______________

PUMPING WELL NUMBER: ______________________
MEASURED WELL NUMBER: ______________________
STEP DRAW DOWN TEST [ ]
MONITORING POINT: ______________________
DEPTH CORRECTION (ft) ______________________
PUMP SETTING (Ft. below monitoring point): ________
DISTANCE FROM PUMPING WELL (ft) (r): ________

PUMPING TEST PERFORMED BY: ______________________
REMARKS: ______________________

MILITARY TIME	ELAPSED TIME SINCE PUMP START OR STOP (Min.)	WATER LEVEL (Ft.)	CORRECTION (Ft.)	DRAW DOWN OR RECOVERY (Ft.)	FLOW METER READING (Gals.)	PUMPING RATE (GPM)	REMARKS

SIGNATURE(s): ______________________

ATTACHMENT C-3

PACKER TEST REPORT FORM

PROJECT: ______________ **PROJECT NO.:** ______________ **TEST NO:** ______________ **PAGE** ____ **OF** ____

BORING NO.: ______________ **CASING DEPTH:** ______________ **CONTRACTOR:** ______________ **STATIC WATER LEVEL** ______________

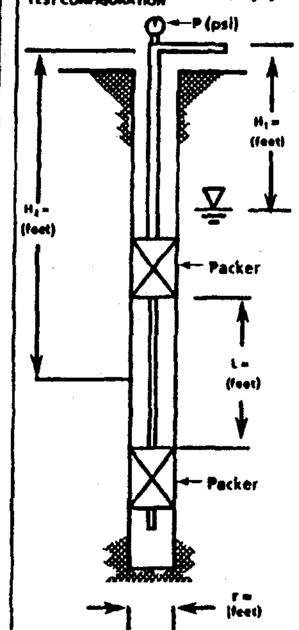
TEST INTERVAL: ______________ **BY:** ______________ **CHECKED:** ______________ **PACKER PRESSURE** ______________

Flow Test					Calculated Results							
Pressure, p (psi)	Elapsed Time (min)	Flow Reading	Δ Flow, ΔQ (ft^3)	Δ Flow, ΔQ (gal)	Flow Rate Q (gal/min)	H_1* (ft)	Hp(Ft) = 2.31·(psi)	H_2* (ft)	H = Hp + (H1 or H2)	Cp	K (ft/yr) = Cp·Q/H	K (cm/sec) = 9.67 x 10^{-7} · K (ft/yr)

CP = (1/(2 π L)) ln(L/r) (70,315 5)
7.48 Gallons = 1 Ft^3
1 psi = 2.31 ft head
Remarks: ____

* H_1 is used when the test length is below the water table.
H_2 is used when the test length is above the water table.

TEST CONFIGURATION



Length of Test Section in feet, l	Cp			
	Drilling Bit Size			
	EX (1.5")	AX (1.875")	BX (2.375")	NX (3")
1	31,000	28,500	25,800	23,300
2	19,400	18,100	16,800	15,500
5	9,800	9,300	8,800	8,200
8	6,800	6,500	6,100	5,800
10	5,700	5,400	5,100	4,900
15	4,100	3,900	3,700	3,600
20	3,200	3,100	3,000	2,800

ATTACHMENT C-4
EXAMPLE BORING LOG

BORING LOG

Page___ of___

PROJECT NAME: ______________________ BORING NUMBER: ______________________
PROJECT NUMBER: ______________________ DATE : ______________________
DRILLING COMPANY: ______________________ GEOLOGIST: ______________________
WATER LEVEL DATA: ______________________

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION			* USCS	Remarks	PID or FID Reading (ppm)
					Soil Density/ Consistency or Rock Hardness	Color	Material Classification			

*When rock coring enter rock brokeness.

CONVERTED TO WELL : ___ Yes ___ No; WELL I.D.#: ______________________
REMARKS: ______________________

Signature(s): ______________________

LEGEND

SOIL TERMS

UNIFIED SOIL CLASSIFICATION (USCS)

COARSE-GRAINED SOILS — More Than Half of Material is LARGER Than No. 200 Sieve Size

FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights)			GROUP SYMBOL	TYPICAL NAMES
GRAVELS (50%(+)>1/4"Ø)	CLEAN GRAVELS (Low % Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
		Predominantly one size or a range of sizes with some intermediate sizes missing.	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.
	GRAVELS W/FINES (High % Fines)	Non-plastic fines (for identification procedures, see ML)	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.
		Plastic fines (for identification procedures, see CL)	GC	Clayey gravels, poorly graded gravel-sand-clay mixtures.
SANDS 50%(+)<1/4"Ø	CLEAN SANDS (Low % Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	SW	Well graded sand, gravelly sands, little or no fines.
		Predominantly one size or a range of sizes with some intermediate sizes missing.	SP	Poorly graded sands, gravelly sands, little or no fines.
	SANDS W/FINES (High % Fines)	Non-plastic fines (for identification procedures, see ML)	SM	Silty sands, poorly graded sand-silt mixtures.
		Plastic fines (for identification procedures, see CL)	SC	Clayey sands, poorly graded sand-clay mixtures.

FINE-GRAINED SOILS — More Than Half of Material is SMALLER Than No. 200 Sieve Size

FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights)	Identification Procedures on Fraction Smaller than No. 40 Sieve Size			GROUP SYMBOL	TYPICAL NAMES
	DAY STRENGTH (Crushing Characteristics)	DILATANCY (Reaction to Shaking)	TOUGHNESS (Consistency Near Plastic Limit)		
SILTS AND CLAYS Liquid Limit <50	None to Slight	Quick to Slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity.
	Medium to High	None to Very Slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
	Slight to Medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity.
SILTS AND CLAYS Liquid Limit >50	Slight to Medium	Slow to None	Slight to Medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
	High to Very High	None	High	CH	Inorganic clays of high plasticity, fat clays.
	Medium to High	None to Very Slow	Slight to Medium	OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS	Readily identified by color, odor, spongy feel and frequently by fibrous texture.			Pt	Peat and other organic soils

Boundary classifications: Soils possessing characteristics of two groups are designated by combining group symbols. For example, GW-GC, well graded gravel-sand mixture with clay binder.
All sieve sizes on this chart are U.S. Standard.

DENSITY OF GRANULAR SOILS

DESIGNATION	STANDARD PENETRATION RESISTANCE-BLOWS/FOOT
Very Loose	0-4
Loose	5-10
Medium Loose	11-30
Dense	31-50
Very Dense	Over 50

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNC COMPRESSIVE STRENGTH (TONS/SQ. FT.)	STANDARD PENETRATION RESISTANCE-BLOWS/FOOT	FIELD IDENTIFICATION METHODS
Very Soft	Less than 0.25	0 to 2	Easily pentrated several inches by fist
Soft	0.25 to 0.50	2 to 4	Easily penetrated several inches by thumb.
Medium Stiff	0.50 to 1.0	4 to 8	Can be penetrated several inches by thumb.
Stiff	1.0 to 2.0	8 to 15	Readily indented by thumb.
Very Stiff	2.0 to 4.0	15 to 30	Readily indented by thumbnail.
Hard	More than 4.0	Over 30	Indented with difficulty by thumbnail.

ROCK TERMS

ROCK HARDNESS (FROM CORE SAMPLES)

Descriptive Terms	Screwdriver or Knife Effects	Hammer Effects
Soft	Easily Gouged	Crushes when pressed with hammer
Medium Soft	Can be Gouged	Breaks (one blow); crumbly edges
Medium Hard	Can be scratched	Breaks (one blow); sharp edges
Hard	Cannot be scratched	Breaks conchoidally (several blows); sharp edges

ROCK BROKENESS

Descriptive Terms	Abbreviation	Spacing
Very Broken	(V. Br.)	0-2"
Broken	(Br.)	2"-1'
Blocky	(Bl.)	1'-3'
Massive	(M.)	3'-10'

LEGEND:

SOIL SAMPLES - TYPES

S-2" Split-Barrel Sample
ST-3" O.D. Undisturbed Sample
O - Other Samples, Specify in Remarks

ROCK SAMPLES - TYPES

X-NX (Conventional) Core (-2-1/8" O.D.)
Q-NQ (Wireline) Core (-1-7/8" O.D.)
Z - Other Core Sizes, Specify in Remarks

WATER LEVELS

12/18 ▼ 12.6' Initial Level w/Date & Depth
12/18 ▼ 12.6' Stabilized Level w/Date & Depth

ATTACHMENT C-5
EXAMPLE OVERBURDEN MONITORING WELL SHEET

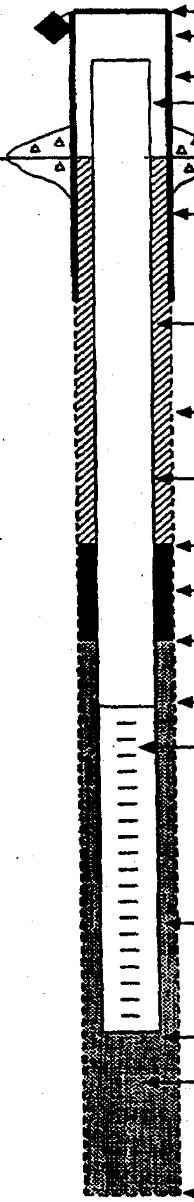
BORING NO.: ______

OVERBURDEN
MONITORING WELL SHEET

PROJECT ______ LOCATION ______
PROJECT NO. ______ BORING ______
ELEVATION ______ DATE ______
FIELD GEOLOGIST ______

DRILLER ______
DRILLING METHOD ______
DEVELOPMENT METHOD ______

GROUND ELEVATION



ELEVATION OF TOP OF SURFACE CASING : ______
ELEVATION OF TOP OF RISER PIPE: ______
STICK - UP TOP OF SURFACE CASING: ______
STICK - UP RISER PIPE : ______
TYPE OF SURFACE SEAL: ______
I.D. OF SURFACE CASING: ______
TYPE OF SURFACE CASING: ______
RISER PIPE I.D. ______
TYPE OF RISER PIPE: ______
BOREHOLE DIAMETER: ______
TYPE OF BACKFILL: ______
ELEVATION / DEPTH TOP OF SEAL: ______ / ______
TYPE OF SEAL: ______
DEPTH TOP OF SAND PACK: ______
ELEVATION / DEPTH TOP OF SCREEN: ______ / ______
TYPE OF SCREEN: ______
SLOT SIZE x LENGTH: ______
I.D. OF SCREEN: ______
TYPE OF SAND PACK: ______
ELEVATION / DEPTH BOTTOM OF SCREEN: ______ / ______
ELEVATION / DEPTH BOTTOM OF SAND PACK: ______ / ______
TYPE OF BACKFILL BELOW OBSERVATION WELL: ______
ELEVATION / DEPTH OF HOLE: ______ / ______

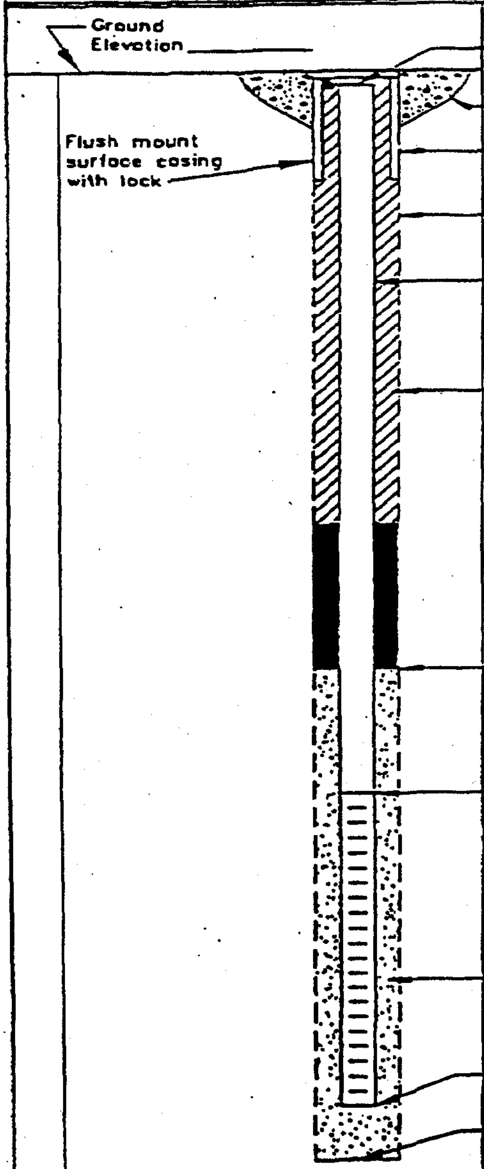
ATTACHMENT C-5A
EXAMPLE OVERBURDEN MONITORING WELL SHEET (FLUSHMOUNT)

BORING NO.: ____

MONITORING WELL SHEET

PROJECT ____ LOCATION ____
PROJECT NO. ____ BORING ____
ELEVATION ____ DATE ____
FIELD GEOLOGIST ____

DRILLER ____
DRILLING METHOD ____
DEVELOPMENT METHOD ____



ELEVATION TOP OF RISER: ____

TYPE OF SURFACE SEAL: ____

TYPE OF PROTECTIVE CASING: ____
I.D. OF PROTECTIVE CASING: ____

DIAMETER OF HOLE: ____

TYPE OF RISER PIPE: ____
RISER PIPE I.D.: ____

TYPE OF BACKFILL/SEAL: ____
____

DEPTH/ELEVATION TOP OF SAND: ____/____

DEPTH/ELEVATION TOP OF SCREEN: ____/____
TYPE OF SCREEN: ____
SLOT SIZE x LENGTH: ____

TYPE OF SAND PACK: ____

DIAMETER OF HOLE IN BEDROCK: ____

DEPTH/ELEVATION BOTTOM OF SCREEN: ____/____
DEPTH/ELEVATION BOTTOM OF SAND: ____/____
DEPTH/ELEVATION BOTTOM OF HOLE: ____/____
BACKFILL MATERIAL BELOW SAND: ____

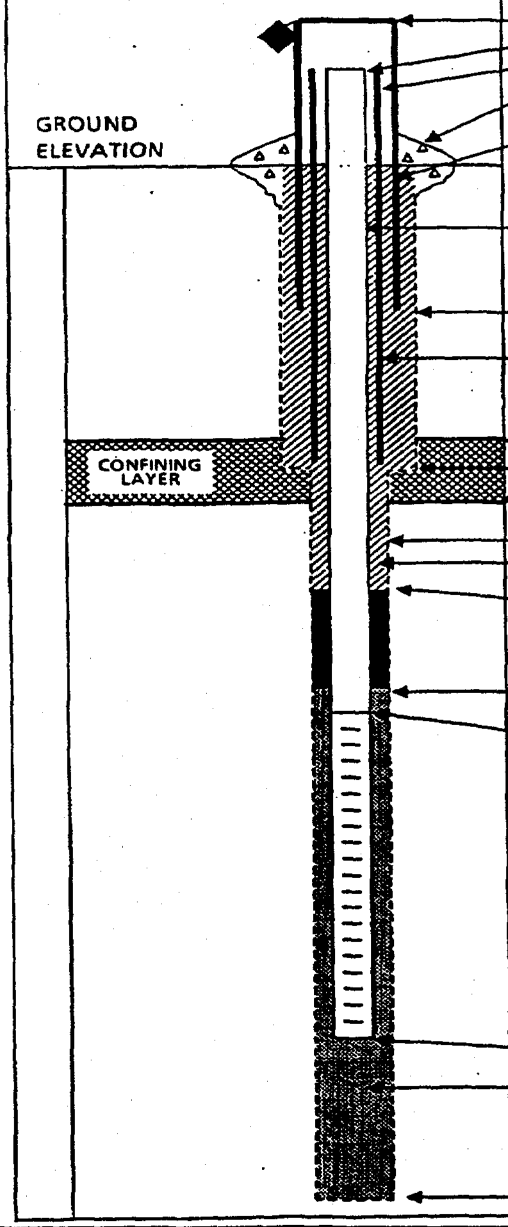
ATTACHMENT C-6
EXAMPLE CONFINING LAYER MONITORING WELL SHEET

BORING NO.: ____________

CONFINING LAYER
MONITORING WELL SHEET

PROJECT ____________ LOCATION ____________
PROJECT NO. ____________ BORING ____________
ELEVATION ____________ DATE ____________
FIELD GEOLOGIST ____________

DRILLER ____________
DRILLING METHOD ____________
DEVELOPMENT METHOD ____________



ELEVATION OF TOP OF SURFACE CASING : ____________
ELEVATION OF TOP OF RISER PIPE: ____________
ELEVATION TOP OF PERM. CASING: ____________
TYPE OF SURFACE SEAL: ____________

I.D. OF SURFACE CASING: ____________
TYPE OF SURFACE CASING: ____________

RISER PIPE I.D. ____________
TYPE OF RISER PIPE: ____________

BOREHOLE DIAMETER: ____________

PERM. CASING I.D. ____________
TYPE OF CASING & BACKFILL: ____________

ELEVATION / DEPTH TOP CONFINING LAYER: ____________
ELEVATION / DEPTH BOTTOM OF CASING: ____________
ELEVATION / DEPTH BOT. CONFINING LAYER: ____________

BOREHOLE DIA. BELOW CASING: ____________
TYPE OF BACKFILL: ____________

ELEVATION / DEPTH TOP OF SEAL: ____________
TYPE OF SEAL: ____________

DEPTH TOP OF SAND PACK: ____________

ELEVATION/DEPTH TOP OF SCREEN: ____________
TYPE OF SCREEN: ____________

TYPE OF SAND PACK: ____________

ELEVATION / DEPTH BOTTOM OF SCREEN: ____________

ELEVATION / DEPTH BOTTOM OF SAND PACK: ____________
TYPE OF BACKFILL BELOW OBSERVATION WELL: ____________

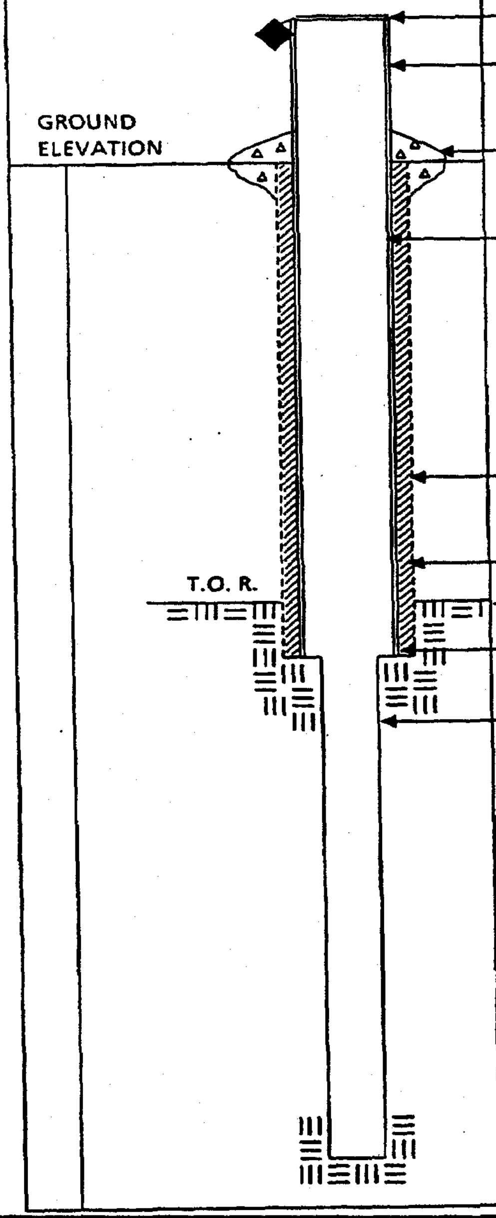
ELEVATION / DEPTH OF HOLE: ____________

ATTACHMENT C-7
EXAMPLE BEDROCK MONITORING WELL SHEET - OPEN HOLE WELL

BORING NO.: ____________

BEDROCK
MONITORING WELL SHEET
OPEN HOLE WELL

PROJECT ____________	LOCATION ____________	DRILLER ____________
PROJECT NO. ____________	BORING ____________	DRILLING METHOD ____________
ELEVATION ____________	DATE ____________	DEVELOPMENT METHOD ____________
FIELD GEOLOGIST ____________		



ELEVATION OF TOP OF CASING: ____________

STICK UP OF CASING ABOVE GROUND SURFACE: ____________

TYPE OF SURFACE SEAL: ____________

____

I.D. OF CASING: ____________

TYPE OF CASING: ____________

TEMP. / PERM.: ____________

DIAMETER OF HOLE: ____________

TYPE OF CASING SEAL: ____________

DEPTH TO TOP OF ROCK: ____________

DEPTH TO BOTTOM CASING: ____________

DIAMETER OF HOLE IN BEDROCK: ____________

DESCRIBE IF CORE / REAMED WITH BIT:

____

____

____

DESCRIBE JOINTS IN BEDROCK AND DEPTH:

____

____

____

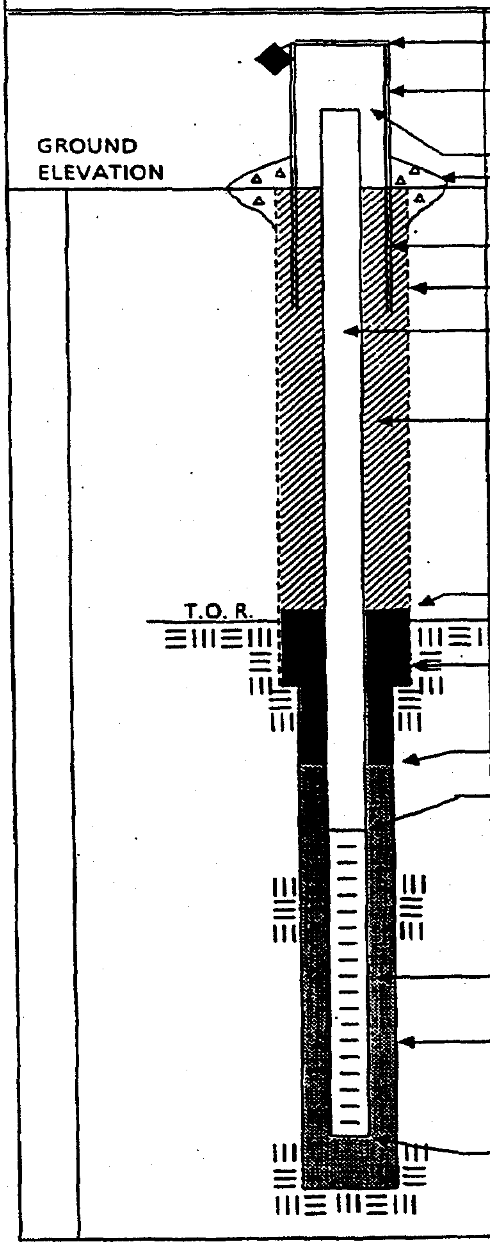
ELEVATION / DEPTH OF HOLE: ______/______

ATTACHMENT C-8
EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK

BORING NO.: ____________

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT ____________ PROJECT NO. ____________ ELEVATION ____________ FIELD GEOLOGIST ____________	LOCATION ____________ BORING ____________ DATE ____________	DRILLER ____________ DRILLING METHOD ____________ DEVELOPMENT METHOD ____________



ELEVATION OF TOP OF SURFACE CASING: ____________

STICK UP OF CASING ABOVE GROUND SURFACE: ____________

ELEVATION TOP OF RISER: ____________

TYPE OF SURFACE SEAL: ____________

I.D. OF SURFACE CASING: ____________

DIAMETER OF HOLE: ____________

RISER PIPE I.D.: ____________

TYPE OF RISER PIPE: ____________

TYPE OF BACKFILL: ____________

ELEVATION / DEPTH TOP OF SEAL: ______/______

ELEVATION / DEPTH TOP OF BEDROCK: ______/______

TYPE OF SEAL: ____________

ELEVATION / DEPTH TOP OF SAND: ______/______

ELEVATION / DEPTH TOP OF SCREEN: ______/______

TYPE OF SCREEN: ____________

SLOT SIZE x LENGTH: ____________

I.D. SCREEN: ____________

TYPE OF SAND PACK: ____________

DIAMETER OF HOLE IN BEDROCK:

CORE / REAM: ____________

ELEVATION / DEPTH BOTTOM SCREEN: ______/______

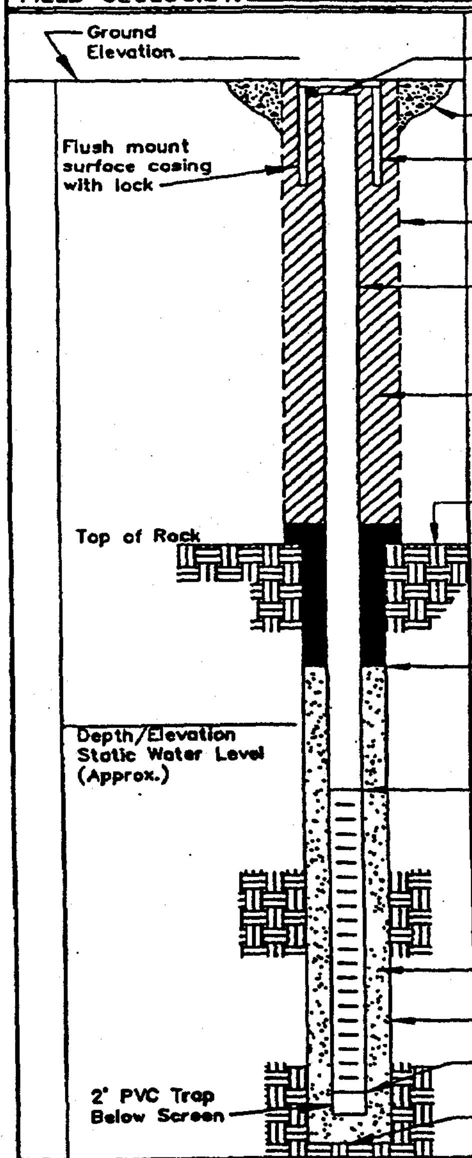
ELEVATION / DEPTH BOTTOM OF HOLE: ______/______

ATTACHMENT C-8A
EXAMPLE BEDROCK MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK (FLUSHMOUNT)

BORING NO.: ____________

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT: ____________	LOCATION: ____________	DRILLER: ____________
PROJECT NO.: ____________	BORING: ____________	DRILLING METHOD: ____________
ELEVATION: ____________	DATE: ____________	DEVELOPMENT METHOD: ____________
FIELD GEOLOGIST: ____________		



ELEVATION TOP OF RISER: ____________

TYPE OF SURFACE SEAL: ____________

TYPE OF PROTECTIVE CASING: ____________

I.D. OF PROTECTIVE CASING: ____________

DIAMETER OF HOLE: ____________

TYPE OF RISER PIPE: ____________

RISER PIPE I.D.: ____________

TYPE OF BACKFILL/SEAL: ____________

____

DEPTH/ELEVATION TOP OF BEDROCK: _____/_____

DEPTH/ELEVATION TOP OF SAND: _____/_____

DEPTH/ELEVATION TOP OF SCREEN: _____/_____

TYPE OF SCREEN: ____________

SLOT SIZE x LENGTH: ____________

TYPE OF SAND PACK: ____________

DIAMETER OF HOLE IN BEDROCK: ____________

DEPTH/ELEVATION BOTTOM OF SCREEN: _____/_____

DEPTH/ELEVATION BOTTOM OF SAND: _____/_____

DEPTH/ELEVATION BOTTOM OF HOLE: _____/_____

BACKFILL MATERIAL BELOW SAND: ____________

ACFILE: L670\GEOL\BEDR1.DWG

ATTACHMENT C-9
EXAMPLE TEST PIT LOG

TEST PIT LOG — **Brown & Root Environmental**

PROJECT: ____________________ TEST PIT NO.:

PROJECT NO ____________ DATE: ____________

LOCATION: ____________________

FIELD GEOLOGIST: ____________________

DEPTH (ft.)	LITHOLOGY CHANGE (Depth/ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS

Test Pit Cross Section and / or Plan View

REMARKS ____________________

PHOTO LOG ____________________

TEST PIT ________

PAGE ____ OF ____

ATTACHMENT D
EXAMPLE EQUIPMENT CALIBRATION LOG

Brown & Root Environmental

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME / MODEL : ____________

JOB NAME : ____________

MANUFACTURER : ____________

JOB NUMBER : ____________

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS

ATTACHMENT E
EXAMPLE DAILY ACTIVITIES RECORD

DAILY ACTIVITIES RECORD — **Brown & Root Environmental**

PROJECT ____________ LOCATION ____________
CLIENT ____________ ARRIVAL TIME ______ JOB NO. ______
DATE ____________ DEPARTURE TIME ______
CONTRACTOR ____________ DRILLER ____________
BORING NO. ____________ HNUS REPRESENTATIVE ____________

ITEM	QUANTITY ESTIMATE	QUANTITY TODAY	PREVIOUS TOTAL QUANTITY	CUMULATIVE QUANTITY TO DATE

COMMENTS: ____________

APPROVED BY:

HNUS FIELD REPRESENTATIVE ____________ DRILLER OR REPRESENTATIVE ____________

ATTACHMENT F
FIELD TRIP SUMMARY REPORT
PAGE 1 OF 2

SUNDAY
Date: ____________________ Personnel: ____________________
Weather: ____________________ Onsite: ____________________

Site Activities: ____________________
____
____
____

MONDAY
Date: ____________________ Personnel: ____________________
Weather: ____________________ Onsite: ____________________

Site Activities: ____________________
____
____
____

TUESDAY
Date: ____________________ Personnel: ____________________
Weather: ____________________ Onsite: ____________________

Site Activities: ____________________
____
____
____

WEDNESDAY
Date: ____________________ Personnel: ____________________
Weather: ____________________ Onsite: ____________________

Site Activities: ____________________
____
____
____

ATTACHMENT F
PAGE 2 OF 2
FIELD TRIP SUMMARY REPORT

THURSDAY

Date: ______________________ Personnel: ______________________
Weather: ______________________ Onsite: ______________________

Site Activities: ____
____
____
____

FRIDAY

Date: ______________________ Personnel: ______________________
Weather: ______________________ Onsite: ______________________

Site Activities: ____
____
____
____

SATURDAY

Date: ______________________ Personnel: ______________________
Weather: ______________________ Onsite: ______________________

Site Activities: ____
____
____
____

APPENDIX C

CLEAR CREEK FLOODPLAIN TIME LINE AND HISTORY

**Time Line for
Clear Creek Floodplain Investigation
NAS Whiting Field, Milton, Florida**

1947 – Aerial Photo 23 July 1947 EAP(w) 0043-2-76 at 40,000 ft
1961 – Aerial Photo 25 March 1961 CPH-1BB-176
1962 – Aerial Photo 26 March 1962, No. VEP-62-4276-5-62
1990 – Aerial Photo 27 January 1990, USDA 1989-165

MAY 1992	RI\FS Technical Memorandum No. 4 Surface Water and Sediment Assessment, Phase I, ABB Environmental Services, Inc.
NOVEMBER 29, 1992	Statement of Work #76 for Drum Removal Issued.
DECEMBER 21, 1992	FDER, Thomas Moody, WM Admin. To Capt. J. E. Eckart, C.O. NAS WHF "We feel that Site 16 should be expanded to include the area, (area with drums observed during Site visit on December 15) all the way to the Clear Creek,...)
DECEMBER 21, 1992	Memorandum John Bleiler, ABB-ES Wakefield Office, Ecological Field Activities November 30 to December 4, 1992.
JANUARY 1993	Plan of Action – Clear Creek Floodplain Investigation and Drum Removal
MARCH 1993	Sampling and Analysis Plan for Clear Creek Floodplain Investigation
APRIL 7, 1993	Memorandum from Scott F. Calkin, ABB-ES; Clear Creek Floodplain Geophysical Investigation Summary, March 17 to 19, 1992.
JULY 1993	Clear Creek Flood Plain Investigation Report CTO 84. Field work completed March 17 to March 26, 1993, Drum removal on April 8 and 20, 1993.
AUGUST 24, 1993	Letter Report Summarizing Analytical Results for Sediment Sample WHF-CCF-SD-14 (Sediment sample collected during drum removal at Clear Creek Floodplain)
OCTOBER 1993	Comments and Responses to Technical Memorandum No. 1 Surface Water and Sediment Assessment, Phase IIA and Clear Creek Flood Plain Investigation.
NOVEMEBER 10, 1993	Meeting Minutes, Response to Comments/Document Review Meeting, November 10, 1993, NAS Whiting Field; Representatives include SDIV, SSEPA, FDEP, and ABB-ES.
JANUARY 10, 1994	Ecological Trip Report for Clear Creek Floodplain at NAS Whiting Field, Milton, Florida.
MARCH 29, 1994	Transmittal of Requested Information for NAS Whiting Field Documents: Technical Memorandum 1 – Surface water and Sediment Assessment Report and Clear Creek Floodplain Investigation Report.
NOVEMBER 2, 1994	Conference Call Meeting Minutes, Clear Creek Floodplain and Industrial Area Contamination.

Clear Creek Floodplain (CCF) Document Summaries

1947 – Aerial Photo 23 July 1947 EAP(w) 0043-2-76 at 40,000 ft. Shows what appears to be a deltaic formation to the west of Site 16. A sediment trail in the shape of a small neck passes through Site 16 and the deltaic formation. It broadens after leaving Site 16 and terminates at Clear Creek. This formation is most probably due to construction and erosion at NAS Whiting as there are other similar features along the Southwestern periphery of NAS Whiting Field. The road around Site 16 is already in place and it appears there is another road, trail or drainage feature down to the neck of the delta. It is unclear what, if any, activity might be going on in this area. Old drainage Ditch A is not visible on the photo but maps indicate that it may line up with the deltaic like feature.

1961 – Aerial Photo 25 March 1961 CPH-1BB-176 At CCF new Drainage Ditch A is present and the perimeter road around Site 16 is still present. The deltaic formation is no longer obvious, but the vegetation in the deltaic local is less dense than that of the surrounding area. There is deltaic like deposition apparent at the end or out fall of New Drainage Ditch A. (New Ditch A may have been built because Old A may have filled up with sediments [see 1947 comments] [Possible theory]) There appears to be three fingers and two lens shape features at the end of New Ditch A. The lenses trend NW-SE parallel with the creek / floodplain. There is very light vegetation cover over the lensic formations. The previous unidentified road, trail, or drainage feature is more clearly shown. It is a road of some type which crosses Site 16 and terminates at the site boundary. Its use probably correlates to activity at Site 16 which was active from 1943 to 1965.

1962 – Aerial Photo 26 March 1962, No. VEP-62-4276-5-62, Photo Copy Version, The Lensic formations at the end of Drainage Ditch A are no longer apparent. A small drainage feature is apparent from the intersection of the Site 16 perimeter road and the a fore mentioned trail / road across 16 to Clear Creek Flood Plain.

1990 – Aerial Photo 27 January 1990, USDA 1989-165 No apparent activity around Site 16. Vegetation was becoming less dense around the CCF area. One lightly colored area just south of Drainage Ditch A. This may be the bog.

May 1992 – Technical Memorandum No. 4 Surface Water and Sediment Assessment, Phase I, ABB Environmental Services, Inc.

NAS Whiting Waste Treatment Plant has been permitted in the past to discharge to the flood plain. The permits were NPDES Waste Water Treatment Plant, Stormwater Discharge, and State of Florida Domestic Waste Water.

Twelve Surface water and sediment samples were collected from Clear Creek and Big Cold Water Creek combined. Eight of the samples were collected from Clear Creek (December 5-7, 1990) This may have been a time of recharge from the stream to the groundwater. Weather was clear with a steady rain starting the morning of December 7. Clear Creek is Class III Water Quality Classification and is suitable for propagation of fish, aquatic life, and body-contact recreation.

Station 8 correlates well to deltaic feature observed in aerial photos west of Site 16. See field notes in Appendix A for description.

In field notes for December 4, 1990, it was noted at Site 17 and 18 there was "some evidence at the two crash training pits of overland migration of oil contaminate water towards small culverts, which go under the road and off installation. These runoff pathways were proposed to be sampled during Phase II."

RESULTS:

SURFACE WATER – CLEAR CREEK.

Barium was detected in all surface water samples at concentrations exceeding 5 times the concentrations detected in QA blanks.

SEDIMENTS – CLEAR CREEK.

Trace pyrene (36 ug/kg) and BEHP (360 ug/kg) were detected at Station 5. Both contaminants were not interpreted as evidence of contamination. They were attributed to the laboratory or natural occuring conditions in nature.

Methylene chloride was detected at Station 5. It was below the quantitation limit and none the blank had a detect of MEK, but it was interpreted as an analytical artifact. The conclusion was to sample again in that location for confirmation.

Benzene was detected at Station 7 at 25 ug/kg.

The following Contaminants were detected at Station 2.
cis-1,2-DCE, 290 up/kg; trans-1,2-DCE, 83 ug/kg; 1,1-DCA, 24 ug/kg; Chromium, 36.9 ug/kg; Copper, 37.5 ug/kg; Lead, 327 ug/kg; Mercury, 0.15 ug/kg; Vanadium, 55.7 ug/kg; and Zinc, 58 ug/kg.

Stations 2 & 7 are close together.

NOVEMBER 29, 1992 – Statement of Work #76 for Drum Removal Issued.

DECEMBER 21, 1992 – FDER, Thomas Moody, WM Admin. To Capt. J. E. Echart, C.O. NAS WHF
"We feel that Site 16 should be expanded to include the area of drums observed during site visit on December 15 and all of Clear Creek. In addition, the area should be investigated as soon as possible because "the drums pose and environmental hazard." Mr. Moody also requested the removal of the drums as soon as possible.

DECEMBER 29, 1992 – From John Bleiler, ABB-Wakefield Ecological Field Activities 30 November to 4 December 1992.

Mr. Bleiler observed that "In the vicinity of floodplain sampling stations 4 and 5, a man made drainage ditch carries surface water from the concrete swale discharge, through the floodplain, and into Clear Creek. This ditch is bordered by extensive hydrophytic floodplain habitats.

While conducting ecological field work in the region of this man-made drainage ditch, petroleum hydrocarbon contamination of floodplain sediments was observed. "Floodplain sediments in this region are saturated with an oily, odorous substance."

The memorandum indicated "Insufficient data were gathered to determine whether or not contamination in this region of the floodplain is having an adverse impact on ecological receptors. As detailed above, preliminary evidence suggest that the benthic macroinvertebrate community in the vicinity of surface water/sediment sampling stations 4 and 5 may be taxonomically depauperate relitave to other sampling stations evaluated."

Mr. Bleiler indicated that white topped pitcher plants (observed), water sundew (not observed), and Florida-anise tree (not observed), are sensitive resources at NAS Whiting Field.

JANUARY 1993 – PLAN OF ACTION CLEAR CREEK FLOODPLAIN INVESTIGATIO AND DRUM REMOVAL

The Plan of Action included a proposal for the collection of 15 sediment samples, a geophysical survey, and the removal of drums.

MARCH 9, 1993 – Sampling and Analysis Plan for Clear Creek Floodplain

Background: Strong petroleum odors were reported from the sediments next to the drum and a hydrocarbon sheen was apparent in the ponded water in the same area. Sediment samples collected during Phase I and IIA investigations confirmed DCE contamination in this area.

During December 1992, an ABB ecologist said that he noticed extensive sediment contamination around the rusted drum and even further upstream in the tributary. Further reconnaissance by ABB-ES personnel indicated that the sediments located between the concrete drainage ditch outfall and Clear Creek produced a petroleum sheen and odor when agitated. An estimate of the depth to contamination was reported at approximately 4 inches below the sediment surface, and only occurred in areas of high organic content in the sediments.

Tributary sediments upstream of the rusted drum were sampled and analyzed for full scan TCL organics and TAL inorganis. The sample was designated SD-01 and collected on 12/09/92.

RESULTS 1,2 DCE 280 ug/kg; Tolune 23 ug/kg; Xylenes (total) 11 ug/kg; 4,4-DDD 28 ug/kg; Chromiun, 52.4 ug/kg; Copper, 42.9 ug/kg; Lead, 777ug/kg; Mercury, 0.57 ug/kg; Vanadium, 57.9 ug/kg; Zinc, 121 ug/kg. Oil and grease 205,000 mg/kg; TFH gas 38 mg/kg and TFH diesel 5300 mg/kg. Variety of TICs.

A floodplain reconnaissance was conducted to locate any additional drums on the ground surface or in the tributaries and Clear Creek. A second drum was identified 100 to 200 yards upstream of confluence of the unnamed tributary and Clear Creek.

April 7, 1993 – MEMORANDUM from Scott F. Calkin, Geophysicist; Clear Creek Floodplan Geophysical Investigation Summary – March 17 to 19 March 1993.

The Geophysical survey identified four drums located on ground surface in the floodplain. In addition, Crew observations indicated a hydrocarbon sheen throughout the survey area.

Technical review of the geophysical data indicated two general anomalies. One anomaly was interpreted to represent the drums located on the land surfaced. The anomaly was somewhat linear with intensity increasing at the drums. The second anomaly was attributed to rear in the concrete structure at the end of the drainage ditch.

The first anomaly generally corresponds to the sediment sample locations 8-11 for the CCFI which had high inorganic concentrations.

July 1993 – TECHNICAL MEMORANDUM No. 1 Surface Water and Sediment Assessment, ABB-ES

Surface water and sediment samples were collected on July 13 to 16, 1992 and August 19, 1992 at 11 stations located in Clear Creek.

Results:
Clear Creek Surface Water.

Detected organic compounds include:
At Station 8, Benzene 1 J ug/l

At Station 6, Benzene 1 J ug/ l (same for its duplicate)
At Station 10, Tricloroethene 1 J ug/l (same for its duplicate)

Inorganic compounds detected above upgradient concentrations include:"
At Station 2, Lead 9.3 ug/l
At Station 8, Nickel 43.2 J ug/l

Concentrations that exceeded ARARs include:
No VOCs, SVOCs, or Pest/PCBs
Aluminum > AWQC at Stations 1,2,3,4,6,7,8,9,10
Beryllium CRDL was > FSWQS, but not detected
Cadmium CRDL >AWQX, at Stations 6 & 8, detected< CRDL but > AWQC
Chromium IV> AWQC at Station 4 (0.7 ug/kg)
Copper > AWQC at Stations 4,6,8 (all detects were < CRDL)
Copper not hardness adjusted, but still Compared to FSWQS, ARARs exceeded at stations 4,5,6,7,8,9,10,11

Iron> FSWQS at Stations 4,9,10
Lead concentrations were < CRDL, but above AWQC and FSWQS at Stations 4,8,9

Silver was detected < CRDL but > AWQC and FSWQSL at Stations 1,4,11

<u>Clear Creek Floodplain Surface Water</u>
Detected compounds include:
Carbon disulfide 1 J ug/l; 1,2-DCE 5 ug/l; Trichloroethene 3 J ug/l at Station 4
Di-n-butylphthalate 16 ug/l at Station 7

<u>Sediment Evaluation</u>
- USEPA sediment quality criteria are dependant on total organic carbon and because no TOC data were available, the guidelines were normalized to an approximated TOC concentration of 1 %

<u>CC Sediments</u>
Acetone and phthalates were detected, however both were attributed to a laboratory or sampling artifact

No Pesticide/PCB compounds were detected.

Station 1 is the upgradient background location
Station 1 contained aluminum, iron, and lead > CRDL
Lead >CRDL at Staion 6,10, but< CRDL at Station 1
All down gradient lead concentrations were < Station 1 concentrations

<u>Clear Creek Floodplain Sediments</u>
Detected VOCs (ug/kg) include:
Methylene Chloride @ Station 7,58 J
Acetone @ Station 4,210 J
1,2-DCE @ Station 4, 13 J
Xylenes @ Station 7, 11

Detected SVOCs (ug/kg) include:
BEHP @ Staion 4, 9300 J; Station 7, 860

Station 7 – Phenanthrene (330 J) Fluoranthene (350 J) Pyrene (400 J)
Benzo(a)anthracene (150 J), Chrysene (210 J), Benzo(b)fluoranthene (220 J),
Benzo(k)fluoranthene (270 J), Benzo(a)pyrene (60 J), Indeno(1,2,,3-cd)pyrene (85 J)

Station 7 is located directly down gradient of Site 16 where diesel fuel was routinely poured on the landfill refuse and burned for 22 years.

Detected Pesticides/ PCBs (ug/kg) include:
Station 4&7 (respectively)
Dieldrin 87 J, 8.6 J, (Station 9 contained 1.7 J)
4,4'-DDE 150 J, 62 J
4,4'DDD 66 J, 35 J
alpha-Chlordane 54 J, 10 J
gamma- Chlordane 53 J, 12 J
Aroclor-1260 450 J, 88 J

Concentrations that exceeded the background criteria
Arenic > BKG @ Station 4
Cadmiun > BKG @ Stations 4,7,9
Chromium > BKG at Station 4 by 76x, and Station 7 by 6x
Mercury > BKG at Station 7
Nickel > BKG at Staion 9
Silver > BKG at Staion 4 and 7
Inc > BKG at Station 4,7,and 9

<u>ARAR Evaluation</u>
No guidence for VOCs

SVOCs
Phenanthrene @ Station 7 > NOAA and EPA
Pyrene @ Station 7 > NOAA

All Pest/ PCB at Station 4,7,9 > NOAA and EPA
At Stations 4 & 7 (respectively)
Dieldrin 87 J, 8.6 L, (also at Station 9)
4,4'- DDE 150 J, 62 J
4, 4' –DDD 66 J, 35 J
alpha-Chloradane 54 J, 10 J
gamma-Chlordane 53J, 12 J
Aroclor- 1260 450 J, 88 J

Inorganic (no EPA guidance only NOAA)
Cadmium, Chromium, Copper, lead, silver, and Zinc > NOAA at Staion 4
Cadmium, Copper, lead, mercury, silver, and zinc > NOAA at Staion 7
Mercury > NOAA at Staion 1,2,3

July 1993 – Clear Creek Flood Plain investigation Report
CTO 84 March 17 to March 26, 1993, Drum removal on April 8 and 20 1993

The field program included : a geophysical survey, TPH Screening according to USEPA 418.1 using GAC Mega-TPH analyzer infrared filtometer and collection of twelve sediment Samples to be analyzed for TCL VOCs, SVOCs, PEST/PCBs, TAL inorganics and TOC and RPH on selected samples.

Geophysical survey results: Anomalous area were defined where drum located and extending to the north (upstream)

TPH results – 3 areas were defined with TPH values > 5000 mg/l, relatively dry floodplain areas had < 1000 mg/l. High TPH were reported in south beaver pond and on the bank of unnamed tributary. The TPH grid was extended to the northwest to identify background levels, but elevated levels were reported along Northeast bank of the North Beaver Pond. May need to investigate further to the northwest.

A sample (WHF-CCF-SD-14) was collected below drum removal area at FDER's request.

The analytical results for the sediment samples are as follows:
VOCs
No VOCs were detected in the background sample.
Acetone, 2-Butanone (MEK) and DCE > CRDL
All three compounds are common lab contaminants and did not appear to be site related.

Carbon disulfied, TCE, 4-Methyl-2-pentanone, and toluene were also detected < CRQLs.

SVOCs
Diethyphthalate, BEHP, and Di-n-octylphthate were detected < CRDL

Pesticides?PCBs
No pesticide or PCB compounds were detected in the background samples.
Dieldrin, 4,4'-DDE, 4,4'-DDD,alpha-Chlordane, gamm-Chlordane, Aroclr- 1260 > CRDL

TPH Field Screening VS. Laboratory results

ANALYTICAL	FIELD SCREENING
Station 6, 189 mg/kg	56 mg/kg
Station 9, 13,700 and 7,940 mg/kg (duplicate)	3485 mg/kg

Both field screening and laboratory samples were analyzed using USEPA method 418.1

TOC
The TOC concentrations ranged from 3,500 to 125,00 mg/kg. The detected background concentrations was 13,400 mg/kg.

Inorganic Background comparison
Chromium > BKG at all Stations but 12
Copper > BKG at all Stations
Lead > BKG at all Stations
Mercury > BKG at 8 Stations
Zinc > BKG at all Stations

<u>ARAR Evaluation</u>
- NOAA and USEPA fpr guidence
- No guidance for VOCs
- All Pesticide/PCBs > NOAA and EPA adjust guidance values for TOC

NOAA is the only ARARs for Inorganic

Chromium > NOAA @ Station 8
Copper > NOAA @ Stations 8, 11
Lead > NOAA @ Stations 2,3,4,5,7,8,9,10,11
Silver > NOAA @ Stations 1,2,3,4,8,9,10,11
Mercury > NOAA @ Stations 2,4,5,7,8,9,10,11
Zinc > NOAA @ Stations 8,11

August 24, 1993 – Letter Report Summarizing Analytical Results for Sediment WHF-CCF-SD-14 (Sample collected at drum removal at the request of FDEP)

TCL VOCs, SVOCs, Pest/PCB were < CRQLs.
Inorganic analytes

Aluminum, Chromium and lead were detected >2x background criteria.
Mercury <2x background criteria.
Mercury concentrations exceeded the NOAA ARARs but so did background concentrations.

OCTOBER 1993- Comments and Responses to Technical Memorandum Surface Water and Sediment Assessment, Phase IIA and Clear Creek Floodplain Investigation

Selected Comment that remain unresolved are as follows:

FDEP Comments
"It is requested by the Navy that FDEP propose methods of inorganic analysis that have detection limits below the FSWQS and AWQS standard. Once the recommendation has been made by FDEP, surface water samples will be collected and analyzed for inorganic elements that have TAL inorganic CRDLs above the ARARs. Additionally concentrations of inorganic analytes in the upstream background surface water sample that exceeds the ARARs would be the result of naturally occurring conditions or from an upstream source unrelated to NAS Whiting."

FDEP Identified possible contamination sources as : 1. Four drums discovered, potential drums upstream yet undiscovered; 2. Surface water runoff from the facility drainage ditches (west end of South Field Runway) ; 3. Possible groundwater discharge from industrial area sites. In addition, they identified the following means of investigation to determine sources and delineate the extent of contamination:

1) Continuation geophysical survey in area northwest of South Beaver Pond. ABB-ES indicated this is unlikely due the presence of 4-6 feet of standing water present year around.
2) Continuation of sediment TPH field screening in the northwest area. ABB-ES agrees this could be done completed from a boat.
3) Collection of surface water samples from concrete drainage ditch effluent discharge. ABB-ES indicates sediments near outfall did not indicate presence of contamination and believe samples should be collected from unnamed tributaries further downstream.
4) Resample locations of samples containing acetone and MEK to determine if these constituents are lab contaminates. ABB-ES indicated this could be done during the next sediment sampling event.

FDEP recommends that a larger map including Site 15 and 16, the drainage ditch and other drainage pathways should be included in future CCFI reports along groundwater contours in the vicinity of Sites 15 and 16.

FDEP recommends and ABB agrees further sediment sampling in the vicinity of the north beaver pond.

FDEP suggests a study of both the benthic and aquatic community to evaluate extent of injury, if any, but Navy Proposes delineatng the nature and extent of contamination prior to designing and implementing a biomonitoring or bioassay study. Further ABB responds the detail of any proposed biological evaluation of the CCF flora and fauna will be presented in the Risk Assessment Work Plan.

USEPA Comments

USEPA identifies that samples should be taken near the drainage outfall, but again Navy responds that elevated TPH readings were not detected at the outfall. Also the USEPA recommends further sediment sampling in the Northwest area for full scan TAL constituents. Navy agrees.

NOVEMBER 10, 1993 – MEETING MINUTES, RESPONSE TO COMMENTS/DOCUMENT REVIEW MEETING, NOVEMBER 10, 1993, NAVAL AIR STATION WHITING FIELD

Rep. Include SDIV, USEPA, FDEP, ABB-ES.

Selected unresolved comments or action items are as follows:

Navy agreed to strike "significant" and "attributable" from Technical Memorandum No. 1 and limit future technical memoranda to statements of facts, rather than interpretations in data. In addition, the Navy agreed to better differentiate between Clear Creek and the Clear Creek Flood Plain, thereby minimizing confusion regarding these two different study areas."

Mr. Pope of EPA concerned CRDLs > AWQO. Solution: Collect 1 Sample 1000 to 2000 feet upstreem of Furthest existing source. The sample will be analyzed for TAL Inorganics. If sample is not contaminated, samples from locations were ARARs were exceeded will be collected and analyzed (using special analyses) for inorganic analytes with CRDLs above the applicable ARARs. If special analyses are required, Mr Pope will contacts USEPA to request low detection analytical methods that can be used to lower the CRDL below the applicable ARARs.

Specific Comment 1.
USEPA requested all historic data be reported. Navy agrees for small data sets. ABB-ES can supply all Data, including previous investigations, in electronic format, as well as hard copy.

USEPA requested delineation of endangered species. ABB-ES presented the result of October Investigation along with discovery of sundew (state-listed) plant. A summary report will be released by Dec. 1993.

USEPA was concerned of over use of "J" as an estimated qualifier. Parties agree to use index or Summary page in Appendix B for the explanation.

FDEP along with USEPA are still concerned about sampling the drainage ditch out fall. ABB-ES explained the correlation of contaminates to silty soils. Navy agreed to collect two sediment samples, one from the outfall area and one from bank of unnamed tributary near outfall, and to screen for TPH. Navy also agreed to collect one surface water sample for CLP analysis from further downstream of outfall but upstream of highest TPH contaminants.

FDEP was concerned about acetone and MEK. Navy agreed to re-sample locations that had high Concentrations of acetone and MEK, as well as any location with DCE.

FDEP indicated that a biological evaluation is needed at the Clear Creek Floodplain, ABB-ES recommended a tiered approach that would be outlined in an ecological risk assessment Work Plan. Navy suggested it would be more economical to conduct certain studies in conjunction with gathering Addition analytical chemistry data on floodplain sediments.

January 10, 1994 – Ecological Trip Report for Clear Creek Floodplain at NAS Whiting Field, Milton Florida.

The ecological assessment identified 1150 individual white-topped pitcher plant and 600 sundew plants (both are state listed plants) in Clear Creek Floodplain. The assessment delineated the Clear Creek Floodplain wetland area and the adjacent upland areas. The assessment also summarized ecological Communities at the floodplain.

MARCH 29, 1994 – TRANSMITTAL OF REQUESTED INFORMATION FOR NAS WHITING FIELD DOCUMENTS: TECHNICAL MEMORANDUM 1 – SURFACE WATER AND SEDIMENT ASSESSMENT REPORT AND CLEAR CREEK FLOODPLAIN INVESTIGATION REPORT.

This transmittal included:

A summary table of Phase I remedial Investigation surface water and sediment data from Clear Creek and Big Coldwater Creek;

- Revised figure 2-1 from Technical memorandum No.1
- The revised figure 3-2 indication indicating 72 TPH screening locations;
- The revised table 4-2 and 4-3 including the background data for sample WHF-CCF-SD-14; and
- Graphical results for two EM-31 geophysical survey profiles.

NOVEMBER 2, 1994 – CONFERENCE CALL MEETING MINUTES – CLEARCREEK FLOODPLAIN AND INDUSTRIAL AREA CONTAMINATION

The primary point of the conference call are summarized below.

- Based on the beaver pond area. To date no specific source area(s) have been defined for the total petroleum hydrocarbons detected in floodplain sediments.
- Based on the current data, the only possible human health concern at Clear Creek would be consumption of fish from the creek. The primary concern at the Clear Creek flood plain is the potential for adverse ecological impacts.
- The Navy is required to assess extent of contamination n the Clear Creek floodplain and to determine whether the detected contaminates may pose an adverse impact to the biological communities.
- The status of Clear Creek flood plain as either part of Operable Unit (OU) or as a separate OU was discussed. Generally it is believed that the Clear Creek flood plain should be treated as a separate OU.
- Stormwater flow and drainage basins should be delineated and a determination as to which, if any, contribute to Clear Creek.
- Additional work will be required to assess the potential source areas, impacts to downstream biological communities, and what impacts to water quality are being caused by groundwater flow from the industrial area.

Additional discussions of the industrial area were completed but are not included here.

APPENDIX D

INVESTIGATION-DERIVED WASTE MANAGEMENT PLAN

DRAFT

REVISED INVESTIGATION-DERIVED WASTE MANAGEMENT PLAN

NAVAL AIR STATION WHITING FIELD MILTON, FLORIDA

Contract No. N62467-89-D-0317

Prepared by:

ABB Environmental Services Inc.
2590 Executive Center Circle, East
The Berkeley Building
Tallahassee, Florida 32301

Prepared for:

Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29411-0068

Jeff Adams, Engineer-in-Charge

March 1996

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Investigation-Derived Waste Management Plan

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GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
AOC	area of contamination
ARARs	applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action, Navy
CLP	USEPA Contract Laboratory Program
CWA	Clean Water Act
DE	disposable equipment
DQO	data quality objective
EC	environmental coordinator
EIC	Engineer-in-Charge
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FID	flame ionization detector
FOL	Field Operations Leader
FR	Federal Register
HDPE	high density polyethylene
HWSF	Hazardous Waste Storage Facility
IDW	investigation-derived waste
LDR	land disposal restrictions
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
$\mu g/\ell$	micrograms per liter
NAS	Naval Air Station
NCP	National Contingency Plan
NPL	National Priority List
OVA	organic vapor analyzer
PCB	polychlorinated biphenyl
PID	photoionization detector
POTW	publicly owned treatment works
PPE	personal protective equipment

GLOSSARY (Continued)

PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation and feasibility study
SOUTNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command
SSL	Soil Screening Levels
SVOC	semi-volatile organic compound
TAL	target analyte list
TCL	target compound list
TCLP	Toxicity Characteristic Leaching Procedure
TL	Technical Leader
TOM	Task Order Manager
TSD	treatment, storage, and disposal
TSCA	Toxic Substances Control Act
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
UTS	Universal Treatment Standards
VOC	volatile organic compound
WWTP	wastewater treatment plant

1.0 INTRODUCTION

ABB Environmental Services (ABB-ES), Inc., is under contract with Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) Contract No. N62467-89-D-0317 to perform an Remedial Investigation/Feasibility Study (RI/FS) at Naval Air Station (NAS) Whiting Field.

When collecting environmental samples to characterize a potential hazardous waste site, a variety of potentially contaminated investigation-derived waste (IDW) are generated (i.e., soil, groundwater, used personal protective equipment (PPE), disposable equipment (DE), and decontamination fluids). The IDW must be managed in a sufficiently responsible manner so that the site is not in a worse state than previously existed and does not pose an immediate threat to human health or the environment.

1.1 PURPOSE. The intent of this IDW plan is to implement a permanent, consistent program for managing wastes derived from the RI/FS of identified sites at NAS Whiting Field. Further, this plan will ensure that health and safety, Federal or State regulations, and Navy requirements are satisfied. This plan defines the roles and responsibilities for ABB-ES personnel, ABB-ES subcontractors, and NAS Whiting Field representatives.

1.2 PLAN GUIDANCE DOCUMENTS. This facility-specific IDW document provides the general guidelines for IDW treatment, storage, and disposal. In completing the document the following regulatory guidelines were reviewed and incorporated where appropriate:

- Management of Investigation-Derived Wastes During Site Inspections (USEPA, May 1991), and
- Management of Contaminated Media Under RCRA (Florida Department of Environmental Protection Interoffice Memo, July 1995; attached).

In addition, all IDW materials will be handled, transported, and disposed of according to Applicable or Relevant and Appropriate Requirements (ARARs) for IDW. The ARARs may include Resource Conservation and Recovery Act (RCRA), the Clean Water Act (CWA), the Toxic Substances Control Act (TSCA), and/or any other existing Federal and State of Florida regulations.

2.0 SITE-SPECIFIC INVESTIGATION-DERIVED WASTE MANAGEMENT PLAN

This section presents the RI site-specific IDW management plan for NAS Whiting Field. Section 2.1 defines and discusses types of IDW expected to be generated at NAS Whiting Field. Disposal options available for each type are also presented. Section 2.2 presents site-specific IDW management and a table depicting the expected disposal methods to be used at each site. Section 2.3 describes equipment and logistics that will be used for IDW management at NAS Whiting Field.

2.1 TYPES OF IDW. The types of IDW expected to be generated during the RI at NAS Whiting Field include: drill cuttings and mud, excavated soils, purge and development water, decontamination fluids, PPE, and DE. The following subsections describe each type of IDW and the available disposal options.

All IDW materials will be handled, transported, and disposed of according to ARARs for IDW. Non-hazardous (non-contaminated) materials will be returned to the site from which they originated and disposed onsite or in a NAS Whiting Field solid waste dumpster, as appropriate.

2.1.1 Drill Cuttings and Mud Depending on site conditions, drill cuttings and mud (earthen IDW) may be disposed of in various ways including: spread on the land surface within the Area of Contamination (AOC), buried within the AOC, or containerized in drums or roll-off boxes. The decision to return wastes to the AOC or containerize them will be determined by the field operations leader (FOL) based on his/her knowledge of the site and the waste.

Perimeter Road Sites. Earthen IDW from the Perimeter Road sites including sites 1, 2, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 31 will be spread out on the ground adjacent to where they were generated to prevent a nuisance condition, physical hazard, or drainage problem. The IDW will be placed so as to minimize erosion by surface water flow or runoff. At perimeter road Site 16, earthen IDW will be segregated into separate piles of saturated and unsaturated soils. The unsaturated soils will be spread on the land surface or buried within the AOC to avoid impacting surface water quality. The saturated soils will be containerized and sampled for hazardous waste determination.

When disposing earthen IDW by burial, the USEPA guidance document Management of Investigation-Derived Wastes During Site Inspections (USEPA, May 1991) will be used. The document states that "burying RCRA hazardous soil cuttings within the AOC unit, so long as no increased hazard to human health and the environment will be created" is consistent with the National Contingency Plan (NCP) and RCRA Land Disposal Restrictions (LDRs). In addition, the IDW guidance document also states "containerization and testing are not required for onsite disposal."

For disposal into a pit, a trench will be constructed within the AOC so that the bottom does not penetrate the water table. If the FOL deems it necessary, the trench sides will be lined with plastic sheeting (16 mil thickness, minimum). Earthen IDW suitable for trench burial will be screened with a photoionization detector (PID) or a flame ionization detector (FID) at the time of excavation. The waste will be transported to the trench within 2 days. After the drilling phase is completed, the earthen IDW within the trench will be covered with a plastic liner (a minimum of 16 mil thickness), followed by a minimum 6-inch thick clean fill cover. The trench surface will be seeded with grass to prevent erosion.

Each trench or pit will contain and isolate its contents, and prevent exposure to humans and the environment. If a site associated with an IDW trench requires remediation or if leachate is encountered at a future date, samples from the trench IDW will be laboratory tested to determine if the materials within the trench require removal or remediation. If removal is warranted, then the material will be removed as part of the remediation effort at that site.

All trenches will be marked and readily identifiable by concreting in place a polyvinyl chloride (PVC) pipe stake (or other non-degradable stake) at each corner. The location of each disposal pit will be surveyed, and the trench location, physical dimensions, and IDW burial information will be recorded in a field log book.

Industrial Area Sites. For sites within the industrial or populated areas including: sites 3, 4, 5, 6, 7, 29, 30, 32, and 33 earthen IDW may be spread on the land surface within the AOC, buried within the AOC, or containerized. The decision to return wastes to the AOC or containerize them will be determined by the FOL based on his/her knowledge of the site and the waste.

If the FOL determines that earthen IDW from a particular excavation or drilling effort should be drummed, ABB-ES will collect an IDW sample from each source (or drum, if no source sample exists) at the completion of a soil boring or excavation. The samples will be analyzed for suspected contaminants that may include: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs) from the target compound list (TCL); inorganics, and total cyanide from the target analyte list (TAL) (Level II Data Quality Objectives (DQOs)).

To determine if the containerized earthen IDW should be classified as hazardous or nonhazardous, RCRA hazardous waste criteria will be used. A RCRA solid waste is hazardous if it is listed in Subpart D of 40 CFR 261 or exhibits a hazardous characteristic defined in 40 CFR 261 as ignitability, corrosivity, reactivity or toxicity. In addition, the wastes will be screened against the Universal Treatment Standard (UTS) values specified in 40 CFR 268.40 and the Soil Screening Levels (SSLs).

Each soil sample analytical results in milligrams per kilogram (mg/kg) will be divided by 20 to yield a conservative estimate of potential leachate concentration in milligrams per liter (mg/l). The estimated concentration will then be compared with the 39 existing toxicity characteristic leaching procedure (TCLP) regulatory concentrations (40 CFR 261). If the soil analytical results indicate concentrations above any TCLP regulatory concentration, the waste will be classified as hazardous and the Installation will be responsible for appropriate disposal according to RCRA Subtitle C.

In addition, the IDW soil sample analytical results will be compared against the values provided in the UTS and SSLs (which ever has higher values will be used), if exceedances are identified the waste will be classified as hazardous and the Installation will be responsible for appropriate disposal according to RCRA Subtitle C.

If the laboratory results indicate contaminants are below the RCRA hazardous waste criteria and the UTS values, the soils will either be disposed of off facility or spread or buried at a designated area of the facility.

Drummed Drill Cuttings or Mud. In general earthen IDW drummed and stored at the site will become the property of NAS Whiting Field. ABB-ES will maintain a log of the drums and will clearly identify the containers using weather-resistant labels. The labels will indicate the drum contents, site and sample location number, date filled, contact person, and corresponding log entry number. NAS Whiting Field will be responsible for the transport, disposal or treatment of the containerized IDWs.

2.1.2 Purge and Development Water. Purge and development water will be disposed of either by discharging on the land surface within the AOC or by containerizing into drums or a mobile storage tanker.

For liquid IDW such as purge and development water, CWA is applicable in addition to RCRA regulations. The CWA addresses site-specific pollutant discharge limitations to protect surface water quality. RCRA hazardous waste water can be disposed of at a Public Owned Treatment Works (POTW) that have a RCRA permit-by-rule and meet the offsite policy criteria for a facility receiving RCRA hazardous waste. Disposal at a POTW of nonhazardous waste waters from Comprehensive Environmental Response and Liability Act (CERCLA) sites is an option if the POTW is acceptable under USEPA's offsite policy.

The hazardous nature of liquid IDW will be determined on a well by well basis by the FOL. The FOL's decision will be based on the following factors: site location well location at site (i.e. background, hot spot, upgradient, downgradient), and knowledge of the waste (i.e., specific analytical results, results of PID/FID screening, visual inspection, and presence of odors).

If purge and development water is determined to be hazardous, the IDW will be contained in drums and stored in a designated area. ABB-ES will submit TAL/TCL analytical results to NAS Whiting Field Hazardous Waste Coordinator upon receipt. NAS Whiting Field will be responsible for the transport, disposal or treatment of the containerized IDW.

If purge and development IDW is determined to be nonhazardous, ABB-ES will discharge the IDW directly on the land surface within the AOC downgradient of the associated well and allow the liquid to percolate into the soil. Care will be taken to insure that the liquid waste percolates into the ground rather than flow into surface waterways.

Nonhazardous purge and development water from monitoring wells in the paved industrial area of NAS Whiting Field may not have an appropriate surface that could assure percolation into the subsurface. In such cases, purge and development water will be contained in drums and ultimately stored in selected compartments of a mobile tanker. NAS Whiting Field will be responsible for the appropriate disposal or treatment of the containerized IDW.

2.1.3 Decontamination Fluids. IDW in the form of decontamination fluids will be discharged either to the waste water treatment plant (WWTP) (via the equipment washrack facility) or onto the ground within the AOC.

The equipment washrack, (Building 2858), located adjacent to the northwest water tower on NAS Whiting Field, will be used to steam clean drill rigs and decontaminate selected field equipment. Rinse water from decontamination operations will be channeled directly into the sewer system which interconnects with the WWTP.

Decontamination fluids produced from decontamination of equipment at the Perimeter Road sites will be discharged onto the ground and allowed to percolate within the AOC.

2.1.4 Personal Protective Equipment (PPE) and Disposable Equipment (DE). PPE (gloves and tyvek suits) and DE (tubing, respirator cartridges, etc.) will be used only at selected sites. PPE and DE may be disposed of in one of two ways. If non-hazardous, PPE and DE will be double-bagged and disposed of in a NAS Whiting Field solid waste dumpster. Or, if contaminated, used PPE and DE will be drummed, labeled, and stored at the NAS Whiting Field hazardous waste storage facility (HWSF) and the Facility will be responsible for appropriate disposal.

The FOL will determine in the field if PPE and DE are to be drummed and sent to the HWSF or double-bagged and disposed of in a local solid waste dumpster. The FOL's decision will be based on the contamination exposure level encountered at each site.

2.2 SITE-SPECIFIC IDW MANAGEMENT

Table 2-1 presents a summary of the types of materials disposed of at each of the sites and lists the analytes of potential concern for each site. Table 2-2 presents the anticipated IDW generated from the RI field program and disposal methods associated with each site at NAS Whiting Field.

WHF-IDW.DOC
GAW.02.96

Table 2-1
Summary of Potential Disposal Sites

Investigation-Derived Waste Document
NAS Whiting Field, Milton, Florida

RI/FS Site No.	Site Name and Type	Period of Operation	Types of Material Disposed	Analytes of Potential Concern[1]
1	Northwest Disposal Area (landfill)	1943-1965	Refuse, waste paints, thinners, solvents, waste oils, and hydraulic fluids.	**Surface Soils** - dieldrin, Cd, Cr, Fe, Hg and K **Groundwater** - Al, Be, Cr, Fe, Pb, Mn and Ni
2	Northwest Open Disposal Area (landfill)	1976-1984	Construction and demolition debris, tires, and furniture.	**Soils** - NA **Groundwater** - BEHP
3	Underground Waste Solvent Storage Area (tank)	1980-1984	Waste solvents, paint stripping residue, and 120-gallon spill.	**Subsurface Soils** - acetone, 2-butanone, TCE, 10 - SVOCs, and 7 pesticides **Groundwater** - BTEX, 1,2-DCE, TCE, tetrachloroethane, BEHP, and heptachlor epoxide
4	North AVGAS Tank Sludge Disposal Area	1943-1968	Tank bottom sludge containing tetraethyl lead.	**Soils** - NA **Groundwater** - 1,2-DCE, TCE, BTEX, 4-methylphenol, BEHP, Al, Cd, Sb, Fe, Pb, and Mn
5	Battery Acid Seepage Pit (contaminated soil)	1964-1984	Waste electrolyte solution containing heavy metals and waste battery acid.	**Soils** - NA **Groundwater** - TCE, tetrachloroethane, benzene, BEHP, Al, Sb, Cd, Cr, Fe, Pb, Mn, and Hg
6	South Transformer Oil Disposal Area (contaminated soil)	1940's-1960's	PCB-contaminated dielectric fluid.	**Subsurface Soils** - 1,1-DCE, 1,2-DCE, 2-butanone, TCE, 19 SVOCs, 4,4-DDD, 4,4-DDE, endosulfan, sulfate and aroclor **Groundwater** - 1,1-DCE, TCE, BEHP, Al, Cd, Fe, Pb and Mn
7	South AVGAS Tank Sludge Disposal Area (landfill and tanks)	1943-1968	Tank bottom sludge containing tetraethyl lead.	**Soils** - NA **Groundwater** - TCE, BTEX, vinyl chloride, 1,2-DCE, Al, An, Cd, Fe, Pb, and Mn
8	AVGAS Fuel Spill Area (contaminated soil)	Summer 1972	AVGAS containing tetraethyl lead.	No Additional Investigation Planned; Received an NFRAP
9	Waste Fuel Disposal Pit (landfill)	1950's-1960's	Waste AVGAS containing tetraethyl lead.	**Soils** - NA **Groundwater** - Al and Fe
10	Southeast Open Disposal Area (A) (landfill)	1965-1975	Construction debris, solvents, paint, oils, hydraulic fluid, PCBs, pesticides, and herbicides.	**Surface Soils** - naphthalene, 2-methyl naphthalene, acenaphthalene, fluorene, phenanthrene, pyrene, aldrin, dieldrin, 4,4-DDE, 4,4-DDD, 4,4-DDT, An, As, Ba, Br, Cd, Ca, Cr, Cu, Fe, Pb, K, Ag, Va and Zn **Groundwater** - Al and Fe

See notes at end of table.

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Table 2-1 (Continued)
Summary of Potential Disposal Sites

Investigation-Derived Waste Document
NAS Whiting Field, Milton, Florida

RI/FS Site No.	Site Name and Type	Period of Operation	Types of Material Disposed	Analytes of Potential Concern[1]
11	Southeast Open Disposal Area (B) (landfill)	1943-1970	Construction and demolition debris, waste solvents, paint, oils, hydraulic fluid, and PCBs.	**Surface Soils** - aldrin, dieldrin, 4,4-DDE, 4,4-DDD, 4,4-DDT, aroclor, As, Ba, Cd, Ca, Cr, Cu, Fe, Pb, Hg, Va, Zn and Cyanide **Groundwater** - Al, Fe, Pb, and Mn
12	Tetraethyl Lead Disposal Area (waste pile)	May 1, 1968	Tank bottom sludge and fuel filters contaminated with tetraethyl lead.	**Soils** - NA **Groundwater** - Cd
13	Sanitary Landfill (landfill)	1979-1984	Refuse, waste solvents, paint, hydraulic fluids, and asbestos.	**Surface Soils** - naphthalene, Al, As, Cr, Fe, Hg, K, Va and cyanide **Groundwater** - BEHP, Al, Cd, Fe, Mn
14	Short-Term Sanitary Landfill (landfill)	1978-1979	Refuse, waste solvents, oils, paint, and hydraulic fluids.	**Surface Soils** - naphthalene, As, Cd, Cr, Fe, Hg and V **Groundwater** - BEHP, Al and Fe
15	Southwest Landfill (landfill)	1965-1979	Refuse, waste paints, oils, solvents, thinners, asbestos, and hydraulic fluid.	**Surface Soils** - naphthalene, 2-methylnaphthalene, 4,4-DDE, aroclor, Cd, Pb, Hg, K and cyanide **Groundwater** - BEHP, Al, Cd, Fe and Mn
16	Open Disposal and Burning Area (landfill)	1943-1965	Refuse, waste paints, oils, solvents, thinners, PCBs, and hydraulic fluid.	**Surface Soils** - naphthalene, 2-methyl naphthalene, acenaphthalene, fluorene, phenanthrene, fluoranthene, pyrene, BEHP, benzo fluoranthene, benzo(a)pyrene, dieldrin, 4,4-DDE, 4,4-DDD, 4,4-DDT, Al, As, Ba, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Ag, Na, V, Zn and cyanide **Groundwater** - 1,2-DCA, TCE, benzene, ethylbenzene, Al, Ba, Cd, Cr, Fe, Pb and Mn
17	Crash Crew Training Area (contaminated soil)	1951-1991	JP-5 fuel.	**Subsurface Soils** - acetone, 2-butanone, 4-methyl-2-pentanone, diethylphthalate, di-n-butylphthalate, 4,4-DDE and 4,4-DDT **Groundwater** - BEHP, Al, Cr, Fe, Pb and Mn
18	Crash Crew Training Area (contaminated soil)	1951-1991	JP-5 fuel.	**Subsurface Soils** - acetone, 2-butanone, 4-methyl-2-pentanone and xylenes **Groundwater** - Al, Fe and Mn
29	Auto Hobby Shop	1943-present	Paint, oils, and solvents	**Subsurface Soils** - acetone, 2-butanone, butylbenzylphthalate, BEHP, dieldrin, 4,4-DDE, 4,4-DDD, 4,4-DDT and chlordane **Groundwater** - Al, An, Cd, Cr, Fe, Pb and Mn

See notes at end of table.

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Table 2-1 (Continued)
Summary of Potential Disposal Sites

Investigation-Derived Waste Document
NAS Whiting Field, Milton, Florida

RI/FS Site No.	Site Name and Type	Period of Operation	Types of Material Disposed	Analytes of Potential Concern[1]
30	South Field Maintenance Hangar	1943-present	Fuels, solvents, and oils	**Subsurface Soils** - acetone, TCE, 2-butanone, 13 SVOCs, dieldrin and 4,4-DDD **Groundwater** - 1,1-DCE, TCE, benzene, xylene, Al, Cd, Fe, Pb and Mn
31	Sludge Drying Beds and Disposal Areas	1943-1990	Wastewater Treatment Plant sludge.	**Surface Soils** - benzo(b)fluoranthene, benzo(k) fluoranthene, dieldrin 4,4-DDE, 4,4-DDT, chlordane, aroclor 1260, Ba, Br,Ca, Cd, Cr, Cu, Fe, Pb, Hg, Se, Ag, Zn and cyanide **Groundwater** - No data available
32	North Field Maintenance Hangar	1943-present	Fuels, solvents, and oils	**Subsurface Soils** - methylene chloride, acetone, 1,2-DCE, 2-butanone, TCE, tetrachloroethane, toluene, ethylbenzene, xylene, 13 SVOCs, 4,4-DDE, $,4-DDD, and aroclor **Groundwater** - 1,2-DCE, TCE, BTEX, BEHP, Al, Cd, Cr, Cu, Fe, Pb and Mn
33	Midfield Maintenance Hangar	1943-present	Fuels, solvents, and oils	**Subsurface Soils** - acetone, TCE. ethylbenzene, xylenes, 7 SVOCs, heptachlor, dieldrin, 4,4-DDE, 4,4-DDT and chlordane **Groundwater** - TCE, Al, Cd, Fe, Mn and Ti

[1] See Technical Memorandum No. 3 - Soils Assessment and 5 - Groundwater Assessment for specifics relative to background concentrations.

Notes: Surface soil samples were screened against 2 times background concentrations.

Subsurface soils samples were screened in that all detected organic analytes but no inorganic analytes were reported. No screening criteria currently exists.

Groundwater were screened in that all analytes detected above Federal or Florida MCLs were reported.

RI/FS = Remedial Investigation and Feasibility Study.
NA = Data is not availabe for either surface or subsurface soils.
AVGAS = aviation gasoline.
PCB = polychlorinated biphenyl.
JP-5 = jet propellant 5.

TABLE 2-2

Expected Investigation-Derived Waste (IDW) Disposal Methods

Site Number	Earthen IDW	Purge and Development Water	Decontamination Fluids	PPE and DE
1	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
2	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
3	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
4	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
5	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
6	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
7	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
9	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
10	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
11	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
12	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster

Site Number	Earthen IDW	Purge and Development Water	Decontamination Fluids	PPE and DE
13	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
14	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
15	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
16	bury within AOC	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
17	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
18	spread or bury within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
29	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
30	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
31	spread, bury within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
32	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
33	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster

Notes: DE - disposable sampling equipment
PPE - personal protective equipment
WWTP - wastewater treatment plant

<u>2.3 EQUIPMENT AND LOGISTICS</u>. The following sub-sections describe the type of materials and equipment that will be used at NAS Whiting Field for handling IDW. Also outlined are responsibilities, and transportation requirements.

<u>2.3.1 Containers</u>. The majority of the containers used onsite will be 55-gallon steel drums, (H or F type). The drums will be in compliance with U.S. Department of Transportation (USDOT), 49 CFR 173. Open head drums (H type) will be constructed of 16-gauge steel, top, bottom and body, as a minimum. Tops will be secured with a 12-gauge bolt ring, bolt, nut, and a sponge rubber gasket. Closed head drums (F type) will be constructed of 18-gauge steel, top, bottom, and body, as a minimum. F type drums will have two vents on the top, 2-inch and 0.75-inch, one for filling and one for venting.

Other containers that may be used onsite for monitoring well purge and development water storage include a water truck/tanker.

2.3.2.1 Labels. All drums containing IDW stored on-site will be labeled in accordance with USDOT requirements (HM-181).

Drummed material will be clearly marked with the following information: drum content, site and well (or sample) number, date containerized, and corresponding log entry number.

2.3.2.2 Transportation. NAS Whiting Field or its subcontractor will transport all liquid waste that has been drummed, stored in a tanker, or stored in a HDPE tank to the WWTP or HWSF. Transportation will be via pick-up truck, flatbed, or tanker, as required.

NAS Whiting Field or its subcontractor will transport all drummed hazardous solid IDW to the base HWSF. Transportation will be via van or flatbed pick-up truck. ABB-ES will coordinate the drum delivery with the NAS Whiting Field Hazardous Waste Coordinator. ABB-ES will provide the analytical results so that the installation can properly label or classify each drum.

2.3.2.3 Empty Drum Storage. Empty drums will be rinsed of any significant soil deposits and transported to a designated storage area identified by NAS Whiting Field Hazardous Waste Coordinator. The drums will be stored on pallets and in a manner that provides secondary containment. The storage container pallets will pallets will be arranged so as to allow access between them for container inspection. Not more than two drums will be stacked vertically together. Drum lids will be secured in place to prevent incidental collection of rainfall.

3.0 POINTS OF CONTACT

This section describes key roles in the management of IDW at NAS Whiting Field and identifies key points of contact.

3.1 ORGANIZATION.

Southern Division Naval Facilities Engineering Command (SOUTHNAVFACENGCOM). SOUTHNAVFACENGCOM is responsible for establishing policy and guidance for the Comprehensive Long-Term Environmental Action, Navy (CLEAN) program. SOUTHNAVFAC-ENGCOM awards contracts, approves funding, and has primary control of report release and interagency communication.

NAS Whiting Field Environmental Coordinator (EC). The NAS Whiting Field ECs, Mr. Jim Holland or Ms. Pat Durbin, will coordinate and monitor IDW activities. The ECs will provide local support and be the primary point of contact with the HWSF Manager and the local, State, and Federal regulatory agencies.

Southern Division Engineer-in-Charge (EIC). The SOUTHNAVFACENGCOM EIC, Mr. Jeff Adams, is responsible for the technical and financial management of the IDW activities at NAS Whiting Field.

Task Order Manager (TOM). The ABB-ES TOM, Mr. Terry Hansen, is responsible for evaluating the appropriateness and adequacy of the technical and engineering services provided during the handling of IDW.

RI/FS Technical Leader (TL). The ABB-ES TL, Mr. Gerry Walker, will be responsible for the quality and completeness of the IDW disposal data gathered during the field program, including overall management and coordination of field work, and supervision and scheduling of work.

Field Operations Leader (FOL). The ABB-ES FOL will vary during differing stages of field work. The FOL will be responsible for ensuring the field activities are performed consistent with the IDW plan. This will include appropriate documentation of all IDW activities at NAS Whiting Field.

3.2 IDW MANAGEMENT TEAM MEMBER LIST. The following is a list of phone numbers for members of the NAS Whiting Field IDW management team.

Navy CLEAN EIC	Jeff Adams	(803) 743-0341
NAS Whiting Field EC	Jim Holland	(904) 623-7667
NAS Whiting Field HWSF Manager	Pat Durbin	(904) 623-7667
ABB-ES Task Order Manager	Terry Hansen	(904) 656-1293
ABB-ES Technical Leader	Gerry Walker	(904) 656-1293
ABB-ES Field Trailer Phone	FOL	(904) 623-7754
USEPA Project Manager	Craig Benedikt	(404) 347-3016
FDEP Project Manager	James H. Cason	(904) 488-3935

REFERENCES:

U. S. Environmental Protection Agency (USEPA), 1991, Management of Investigation-Derived Waste During Site Inspections, EPA/540/G-91/009, May 1991.

Florida Department of Environmental Protection, 1995, Interoffice Memorandum, Management of Contaminated Waste Under RCRA, July 1995.

ATTACHMENT I

INTRODUCTION:

The following guidance was developed to be used for RCRA sites, that potentially may generate contaminated media through site investigation or corrective action/remediation activities.

This guidance does not change or supersede specific RCRA, CERCLA, or any other regulatory requirements. The outline below is to be used as interim guidance for handling contaminated media. It is anticipated that EPA will finalize a rule addressing management of contaminated media. This interim guidance will be finalized after the EPA rule is promulgated.

This guidance addresses contaminated media with contamination originating from a characteristic source or a listed source.

The objective of this guidance is to bring uniformity and consistency to the manner in which different programs in the Department handle, or require respondents/permittees to handle, contaminated media subject to RCRA requirements when contamination is above specified concentrations outlined in this memo. Approval of procedures for managing media below these concentrations will be the responsibility of the Department staff overseeing the specific project.

This guidance does not apply to contaminated media solely from petroleum cleanup sites. However it will be applicable to sites that have both petroleum and non-petroleum contamination.

INTERPRETATION:

The following criteria clarify the use of Land Disposal Universal Treatment Standards (UTSs) in determining if contaminated media (from a listed or characteristic source) are subject to RCRA Subtitle C regulation (see flowchart on Page 4):

1. Contaminated media exhibiting hazardous waste characteristics shall be managed as hazardous waste and are subject to full RCRA Subtitle C regulation.

2. (a) For Waste Water: All waste water with hazardous constituent concentrations exceeding the Universal Treatment Standards (UTSs), (40 CFR 268.40), or the Maximum Contamination Levels (MCLs), (F.A.C. Chapter 62-550), whichever is

higher, is considered hazardous waste and shall be managed in accordance with RCRA Subtitle C requirements.

(b) For Contaminated Soils: All soils with hazardous constituent concentrations exceeding the Universal Treatment Standards (UTSs), (40 CFR 268.40), or the Soil Screening Levels (SSL developed in accordance with EPA guidance), whichever is higher, are considered hazardous waste and shall be managed in accordance with RCRA Subtitle C requirements.

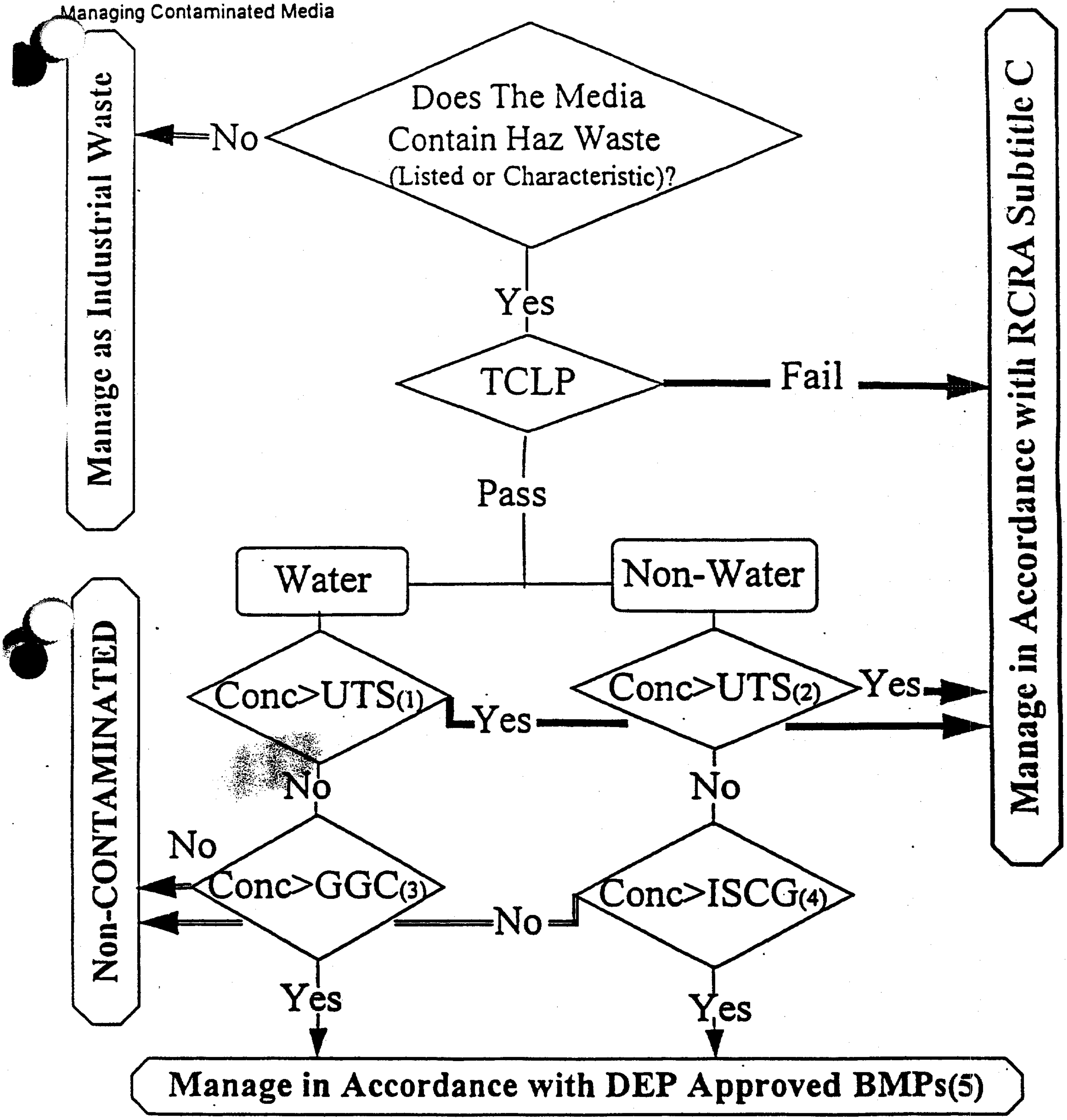
3. Contaminated media with hazardous constituent concentrations less than the UTSs (or SSLs/MCLs in cases where SSLs/MCLs are higher than UTSs) will not be subject to RCRA Subtitle C requirements, and shall be managed using Department approved best management practices (BMPs).

4. Contaminated media with hazardous constituent concentrations less than Groundwater Guidance Concentration levels (GGC) or the Interim Soil Cleanup Goal levels (ISCG developed by the Department's Bureau of Waste Cleanup), are considered decontaminated.

<u>Department approved BMPs must be applied in managing media containing hazardous waste constituents at concentrations below the standards specified above in item 3,</u> otherwise, media will be subject to full RCRA Subtitle C regulation.

BMPs will be reviewed by Department staff overseeing a specific project as a portion of the submitted assessment, interim measures, or corrective action (remediation) plans, and determine their adequacy.

ATTACHMENT II



(1) In cases where MCL > UTS, MCL is considered in this step. In cases where there is no UTS for a contaminant, media management practices will be evaluated on a case to case basis.

(2) In cases where Soil Screening Levels (As developed in accordance to EPA's Soil Screening Levels "SSL" guidance) are greater than UTS levels, SSLs will be considered.

(3) GGC = Florida Groundwater Guidance Concentrations

(4) ISCG = Interim Soil Cleanup Goals Developed by Bureau of Waste Cleanup

(5) BMPs = Best Management Plans. BMPs are to be reviewed and approved by the Bureau/District overseeing the specific project.

Florida Department of

Environmental Protection

Interoffice Memorandum

To: Waste Management Program Administrators

From: Satish Kastury, Environmental Administrator, HW Regulation

Date: July 27, 1995

Subject: Management of Contaminated Media under RCRA

Pursuant to our discussion during the WPAs meeting regarding contaminated media, provided are two attachments addressing management of contaminated media under RCRA.

The criteria listed in Attachment I under items 1, 2, 3 and 4 have already been reviewed by Bill Burns, Dan DeDomenico, Bill Martin, Jim Crane, Tom Conrardy, and Ligia Mora-Applegate of Waste Cleanup, and their comments were incorporated. Your comments from the discussion during the last WPAs Meeting were also incorporated into the text in Attachment I, and into the flowchart presented in Attachment II.

Should you have any questions, please contact me, Doug Outlaw, or Maher Budeir of my staff.

cc: John Ruddell; ....Division Director, Waste Management.
Bill Hinkley; ....Bureau Chief, Bureau of Solid and Hazardous Waste
Alan Farmer; ....EPA, Region IV
Doug Jones; ....Bureau Chief, Bureau of Waste Cleanup
Jim Crane;.....................Bureau of Waste Cleanup
Bill Burns;......................Bureau of Waste Cleanup
Dan DeDomenico; ....Bureau of Waste Cleanup
Bill Martin; ....Bureau of Waste Cleanup
Ligia Mora-Applegate;...Bureau of Waste Cleanup
Diana Coleman;............OGC
Agusta Posner; ....OGC
Doug Outlaw
Maher Budeir
Mike Redig
Merlin Russell
RCRA Permitting and Compliance Technical Committee Members

APPENDIX E

HEALTH AND SAFETY PLAN

Health and Safety Plan
for
Remedial Investigation/Feasibility Study

Naval Air Station Whiting Field
Milton, Florida

Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order 0079

January 2000

HEALTH AND SAFETY PLAN
FOR
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29419-9010

Submitted by:
TetraTech NUS, Inc.
661 Andersen Drive
Foster Plaza 7
Pittsburgh, Pennsylvania 15220-2745

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0079

JANUARY 2000

SUBMITTED BY:

TERRY HANSEN
TASK ORDER MANAGER
TETRA TECH NUS, INC.
TALLAHASSEE, FLORIDA

APPROVED BY:

MATTHEW M. SOLTIS, CIH, CSP
CLEAN HEALTH & SAFETY MANAGER
TETRA TECH NUS, INC
PITTSBURGH, PENNSYLVANIA

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FOREWORD

To meet its mission objectives, the U.S. Navy performs a variety of operations, some requiring the use, handling, storage, or disposal of hazardous materials. Through accidental spills and leaks and conventional methods of past disposal, hazardous materials may have entered the environment. With growing knowledge of the long-term effects of hazardous materials on the environment, the U. S. Department of Defense initiated various programs to investigate and remediate conditions related to suspected past releases of hazardous materials at its facilities.

One of these programs is the Installation Restoration (IR) program. This program complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), the Resource Conservation and Recovery Act, and the Hazardous and Solid Waste Amendments of 1984. These acts establish the means to assess and clean up hazardous waste sites for both private-sector and federal facilities. The CERCLA and SARA acts form the basis for what is commonly known as the Superfund program.

Originally, the Navy's part of this program was called the Naval Assessment and Control of Installation Pollutants (NACIP) program. Early reports reflect the NACIP process and terminology. The Navy eventually adopted the program structure and terminology of the standard IR program.

The IR program consists of Preliminary Assessment (PA) and Site Inspections (SIs), Remedial Investigation (RI) and Feasibility Study (FS), and Remedial Design (RD) and Remedial Action (RA) at sites where chemicals were allegedly spilled or disposed of. The PA and SI identify the presence of pollutants. The nature and extent of contamination as well as the selected remedial solutions are determined during the RI/FS. The RD and RA are performed to complete implementation of the solution.

The health and safety procedures to be followed during investigation activities at NAS Whiting Field are discussed in this report.

The Southern Division, Naval Facilities Engineering Command manages and the U.S. Environmental Protection Agency and the Florida Department of Environmental Protection (formerly the Florida Department of Environmental Regulation) oversee the Navy environmental program at Naval Air Station (NAS) Whiting Field. All aspects of the program are conducted in compliance with state and federal regulations, as ensured by the participation of these regulatory agencies.

Questions regarding the CERCLA program at NAS Whiting Field should be addressed to Ms. Linda Martin, Code 1878, at (843) 820-5574.

1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been developed to provide practices and procedures for Tetra Tech NUS, Inc. (TtNUS) and subcontractor personnel engaged in investigatory activities at the Naval Air Station Whiting Field (NAS Whiting Field), in Milton, Florida. This HASP must be used in conjunction with the TtNUS Health and Safety Guidance Manual. Both of these documents must be present at the site during the performance of all site activities. The Guidance Manual provides detailed information pertaining to the HASP as well as applicable TtNUS Standard Operating Procedures (SOPs). This HASP and the contents of the Guidance Manual were developed to comply with the requirements stipulated in 29 CFR 1910.120 (OSHA's Hazardous Waste Operations and Emergency Response Standard), OSHA's Construction Industry Standards, 29 CFR 1926; and NAS Whiting Field procedures and protocol, as they may apply.

This HASP has been developed using the latest available information regarding known or suspected chemical contaminants and potential physical hazards associated with the proposed work at the site. The HASP will be modified, if new information becomes available. All changes to the HASP will be made with the approval of the TtNUS Project Health and Safety Officer (PHSO) and the TtNUS Health and Safety Manager (HSM). Requests for modifications to the HASP will be directed to the PHSO, who will determine if the changes are necessary. The PHSO will notify the Task Order Manager (TOM), who will notify all affected personnel of changes.

1.1 KEY PROJECT PERSONNEL AND ORGANIZATION

This section defines responsibility for site safety and health for TtNUS and subcontractor employees engaged in onsite activities. Personnel assigned to these positions will exercise the primary responsibility for all onsite health and safety. These persons will be the primary point of contact for any questions regarding the safety and health procedures and the selected control measures that are to be implemented for onsite activities.

- The TtNUS TOM is responsible for the overall direction of health and safety for this project.

- The PHSO is responsible for developing this HASP in accordance with applicable OSHA regulations. Specific responsibilities include:

i. Providing information regarding site contaminants and physical hazards associated with the site.
ii. Establishing air monitoring and decontamination procedures.
iii. Assigning personal protective equipment based on task and potential hazards.
iv. Determining emergency response procedures and emergency contacts.
v. Stipulating training requirements and reviewing appropriate training and medical surveillance certificates.
vi. Providing standard work practices to minimize potential injuries and exposures associated with hazardous waste work.
vii. Modify this HASP, as it becomes necessary.

- The TtNUS Field Operations Leader (FOL) is responsible for implementation of the HASP with the assistance of an appointed SSO. The FOL manages field activities, executes the work plan, and enforces safety procedures as applicable to the work plan.

- The SSO supports site activities by advising the FOL on all aspects of health and safety on site. These duties may include:

i. Coordinates all health and safety activities with the FOL.
ii. Selects, applies, inspects, and maintains personal protective equipment.
iii. Establishes work zones and control points in areas of operation.
iv. Implements air monitoring program for onsite activities.
v. Verifies training and medical clearance of onsite personnel status in relation to site activities.
vi. Implements Hazard Communication, Respiratory Protection Programs, and other associated health and safety programs as they may apply to site activities..
vii. Coordinates emergency services.
viii. Provides site-specific training for all onsite personnel.
ix. Investigates all accidents and injuries (see Attachment I - Illness/Injury Reporting Procedure and Form)
x. Provides input to the PHSO regarding the need to modify, this HASP, or applicable health and safety associated documents as per site-specific requirements.

- Compliance with the requirements stipulated in this HASP is monitored by the SSO and coordinated through the TtNUS CLEAN HSM.

Note: In some cases one person may be designated responsibilities for more than one position. For example, at NAS Whiting Field the FOL will also be responsible for SSO duties. This action will be performed only as credentials or experience permits.

1.2 SITE INFORMATION AND PERSONNEL ASSIGNMENTS

Site Name:	Naval Air Station Whiting Field Milton, Florida	Client Contact: Phone Number:	Linda Martin (843) 820-5574
Navy Onsite Representative	Jim Holland	Phone Number:	(850) 623-7181 X149

Scheduled Activities: This activity will be divided into a multi-task operation, including the tasks of soil boring (drilling), monitoring well installation, and multi-media sampling. Further details on these and other site tasks can be found in Section 4 of this HASP.

Dates of scheduled activities: Site activities are expected to begin in March 1999 and continue until project completion.

Project Team:

TtNUS Management Personnel:	Discipline/Tasks Assigned:
Terry Hansen	Task Order Manager (TOM)
TBD	Field Operations Leader (FOL)
TBD	Site Safety Officer (SSO)
Matthew M. Soltis, CIH, CSP	CLEAN Health and Safety Manager
Delwyn E. Kubeldis, CIH, CSP	Project Health and Safety Officer (PHSO)

Other Potential TtNUS Project Personnel:

TBD	Field Geologist

Non-TtNUS Personnel Affiliation/Discipline/Tasks Assigned

TBD	Drilling subcontractor(s)

Prepared by: Delwyn E. Kubeldis, CIH, CSP

2.0 EMERGENCY ACTION PLAN

2.1 INTRODUCTION

This section has been developed as part of a preplanning effort to direct and guide field personnel in the event of an emergency. All site activities will be coordinated with the client contact, Linda Martin. In the event of an emergency which cannot be mitigated using onsite resources, personnel will evacuate to a safe place of refuge and the appropriate emergency response agencies will be notified. It has been determined that the majority of potential emergency situations would be better supported by outside emergency responders. Based on this determination, TtNUS and subcontractor personnel will not provide emergency response support beyond the capabilities of onsite response. Workers who are ill or who have suffered a non-serious injury may be transported by site personnel to nearby medical facilities, provided that such transport does not aggravate or further endanger the welfare of the injured/ill person. The emergency response agencies listed in this plan are capable of providing the most effective response, and as such, will be designated as the primary responders. These agencies are located within a reasonable distance from the area of site operations, which ensures adequate emergency response time. NAS Whiting Field contact Jim Holland will be notified anytime outside response agencies are contacted. This Emergency Action Plan conforms to the requirements of 29 CFR 1910.38(a), as allowed in 29 CFR 1910.120(l)(1)(ii).

TtNUS will, through necessary services, provide the following emergency action measures:

- Incipient stage fire fighting support and prevention
- Incipient spill control and containment measures and prevention
- Removal of personnel from emergency situations
- Initial medical support for injuries or illnesses requiring basic first-aid
- Site control and security measures as necessary

2.2 PRE-EMERGENCY PLANNING

Through the initial hazard/risk assessment effort, emergencies resulting from chemical, physical, or fire hazards are the types of emergencies that could be encountered during site activities.

To minimize and eliminate the potential for these emergency situations, pre-emergency planning activities will include the following (which are the responsibility of the SSO and/or the FOL):

- Coordinating with local Emergency Response personnel to ensure that TtNUS emergency action activities are compatible with existing emergency response procedures. Base Fire Protection and Emergency Services will be notified of scheduled events and activities. This is most imperative in situations where their services may be required.

- Establishing and maintaining information at the project staging area (support zone) for easy access in the event of an emergency. This information will include the following:

  - Chemical Inventory (of chemicals used onsite), with Material Safety Data Sheets.
  - Onsite personnel medical records (Medical Data Sheets).
  - A log book identifying personnel onsite each day.
  - Hospital route maps with directions (these should also be placed in each site vehicle).
  - Emergency Notification - phone numbers..

The TtNUS FOL will be responsible for the following tasks:

- Identifying a chain of command for emergency action.

- Educating site workers to the hazards and control measures associated with planned activities at the site, and providing early recognition and prevention, where possible.

- Periodically performing practice drills to ensure site workers are familiar with incidental response measures.

- Providing the necessary equipment to safely accomplish identified tasks.

2.3 EMERGENCY RECOGNITION AND PREVENTION

2.3.1 Recognition

Emergency situations that may be encountered during site activities will generally be recognized by visual observation. Visual observation is primarily relevant for physical hazards that may be associated with the proposed scope of work. Visual observation will also play a role in detecting some chemical hazards. To adequately recognize chemical exposures, site personnel must have a clear knowledge of signs and symptoms of exposure associated with site contaminants. This information is provided in Table 6-1. Tasks to be performed at the site, potential hazards associated with those tasks and the recommended control methods are discussed in detail in Sections 5.0 and 6.0. Additionally, early recognition of hazards will be supported by daily site surveys to eliminate any situation predisposed to an emergency. The FOL and/or the SSO will be responsible for performing surveys of work areas prior to initiating site operations and periodically while operations are being conducted. Survey findings will be documented by the FOL and/or the SSO in the Site Health and Safety logbook, however, all site personnel will be responsible for reporting hazardous situations. Where potential hazards exist, TtNUS will initiate control measures to prevent adverse effects to human health and the environment.

The above actions will provide early recognition for potential emergency situations, and allow TtNUS to instigate necessary control measures. However, if the FOL and the SSO determine that control measures are not sufficient to eliminate the hazard, TtNUS will withdraw from the site and notify the appropriate response agencies listed in Table 2-1.

2.3.2 Prevention

TtNUS and subcontractor personnel will minimize the potential for emergencies by following the Health and Safety Guidance Manual and ensuring compliance with the HASP and applicable OSHA regulations. Daily site surveys of work areas, prior to the commencement of that day's activities, by the FOL and/or the SSO will also assist in prevention of illness/injuries when hazards are recognized early and control measures initiated.

2.4 EVACUATION ROUTES, PROCEDURES, AND PLACES OF REFUGE

An evacuation will be initiated whenever recommended hazard controls are insufficient to protect the health, safety or welfare of site workers. Specific examples of conditions that may initiate an evacuation include, but are not limited to the following: severe weather conditions; fire or explosion; monitoring instrumentation readings which indicate levels of contamination are greater than instituted action levels; and evidence of personnel overexposure to potential site contaminants.

In the event of an emergency requiring evacuation, all personnel will immediately stop activities and report to the designated safe place of refuge unless doing so would pose additional risks. When evacuation to the primary place of refuge is not possible, personnel will proceed to a designated alternate location and remain until further notification from the TtNUS FOL. Safe places of refuge will be identified prior to the commencement of site activities by the SSO and will be conveyed to personnel as part of the pre-activities training session. This information will be reiterated during daily safety meetings. Whenever possible, the safe place of refuge will also serve as the telephone communications point for that area.

During an evacuation, personnel will remain at the refuge location until directed otherwise by the TtNUS FOL or the on-site Incident Commander of the Emergency Response Team. The FOL or the SSO will perform a head count at this location to account for and to confirm the location of all site personnel. Emergency response personnel will be immediately notified of any unaccounted personnel. The SSO will document the names of all personnel onsite (on a daily basis) in the site Health and Safety Logbook. This information will be utilized to perform the head count in the event of an emergency.

Evacuation procedures will be discussed during the pre-activities training session, prior to the initiation of project tasks. Evacuation routes from the site and safe places of refuge are dependent upon the location at which work is being performed and the circumstances under which an evacuation is required. Additionally, site location and meteorological conditions (i.e., wind speed and direction) may dictate evacuation routes. As a result, assembly points will be selected and communicated to the workers relative to the site location where work is being performed. Evacuation should always take place in an upwind direction from the site.

2.5 DECONTAMINATION PROCEDURES / EMERGENCY MEDICAL TREATMENT

During any site evacuation, decontamination procedures will be performed only if doing so does not further jeopardize the welfare of site workers. Decontamination will not be performed if the incident warrants immediate evacuation. However, it is unlikely that an evacuation would occur which would require workers to evacuate the site without first performing the necessary decontamination procedures.

TtNUS personnel will perform removal of personnel from emergency situations and may provide initial medical support for injury/illnesses requiring only first-aid level support. Medical attention above that level will require assistance and support from the designated emergency response agencies. Attachment II provides the procedure to follow when reporting an injury/illness, and the form to be used for this purpose **If the emergency involves personnel exposures to chemicals, follow the steps provided in Figure 2-1.**

TABLE 2-1

EMERGENCY REFERENCE
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

CONTACT	PHONE NUMBER
EMERGENCY (Milton Police, Fire, and Ambulance Services)	911
Santa Rosa Medical Center (Primary Hospital)	(850) 623-9741
West Florida Regional Medical Center (Alternate Hospital)	(850) 478-4460
Navy Onsite Representative at NAS Whiting Field Jim Holland	(850) 623-7181 ext. 149
Task Order Manager Terry Hansen	(850) 656-5458
Chemtrec National Response Center	(800) 424-9300 (800) 424-8802
TtNUS Tallahassee Office	(850) 656-5458
TtNUS, Pittsburgh Office	(412) 921-7090
Health and Safety Manager Matthew M. Soltis, CIH, CSP	(412) 921-8912
Project Health and Safety Officer Delwyn E. Kubeldis, CIH, CSP	(412) 921-8529
Utilities Jim Holland	(850) 623-7181 ext. 149

2.6 EMERGENCY ALERTING AND ACTION/RESPONSE PROCEDURES

TtNUS personnel will be working in close proximity to each other at NAS Whiting Field. As a result, hand signals, voice commands, and line of site communication will be sufficient to alert site personnel of an emergency. When project tasks are performed simultaneously on different sites, vehicle horns will be used to communicate emergency situations.

If an emergency warranting evacuation occurs, the following procedures are to be initiated:

Initiate the evacuation via hand signals, voice commands, line of site communication, or vehicle horns.

- Report to the designated refuge point.
- Once all non-essential personnel are evacuated, appropriate response procedures will be enacted to control the situation.
- Describe to the FOL (FOL will serve as the Incident Coordinator) pertinent incident details.

FIGURE 2-1
EMERGENCY RESPONSE PROTOCOL

The purpose of this protocol is to provide guidance for the medical management of exposure situations.

In the event of a personnel exposure to a hazardous substance or agent:

- Rescue, when necessary, employing proper equipment and methods.
- Give attention to emergency health problems -- breathing, cardiac function, bleeding, shock.
- Transfer the victim to the medical facility designated in this HASP by suitable and appropriate conveyance (i.e. ambulance for serious events)
- Obtain as much exposure history as possible (a Potential Exposure report is attached).
- If the exposed person is a Tetra Tech NUS employee, call the medical facility and advise them that the patient(s) is/are being sent and that they can anticipate a call from the Continuum Healthcare physician. Continuum Healthcare will contact the medical facility and request specific testing which may be appropriate. The care of the victim will be monitored by Continuum Healthcare physicians. Site officers and personnel should not attempt to get this information, as this activity leads to confusion and misunderstanding.
- Call Continuum Healthcare at 1-800-229-3674, being prepared to provide:
  - Any known information about the nature of the exposure.
  - As much of the exposure history as was feasible to determine in the time allowed.
  - Name and phone number of the medical facility to which the victim(s) has/have been taken.
  - Name(s) of the exposed Tetra Tech NUS, Inc. employee(s).
  - Name and phone number of an informed site officer who will be responsible for further investigations.
  - Fax appropriate MSDS to Continuum Healthcare at (770) 457-1429.
- Contact Corporate Health and Safety Department (Matt Soltis) at 1-800-245-2730.

As environmental data is gathered and the exposure scenario becomes more clearly defined, this information should be forwarded to the Continuum Healthcare Medical Director or Assistant Medical Director.

Continuum Healthcare will compile the results of all data and provide a summary report of the incident. A copy of this report will be placed in each victim's medical file in addition to being distributed to appropriately designated company officials.

Each involved worker will receive a letter describing the incident but deleting any personal or individual comments. This generalized summary will be accompanied by a personalized letter describing the individual's findings/results. A copy of the personal letter will be filed in the continuing medical file maintained by Continuum Healthcare.

FIGURE 2-1 (continued)
POTENTIAL EXPOSURE REPORT

Name: ______________________ Date of Exposure: ____________

Social Security No.: ______________ Age: ________ Sex: ________

Client Contact: ______________________ Phone No.: ____________

Company Name: ______________________

I. Exposing Agent

Name of Product or Chemicals (if known):______________________

____

Characteristics (if the name is not known)

Solid Liquid Gas Fume Mist Vapor

II. Dose Determinants

What was individual doing?______________________

How long did individual work in area before signs/symptoms developed? ____________

Was protective gear being used? If yes, what was the PPE? ____________

Was there skin contact?______________________

Was the exposing agent inhaled?______________________

Were other persons exposed? If yes, did they experience symptoms? ____________

III. Signs and Symptoms (check off appropriate symptoms)

Immediately With Exposure:

Burning of eyes, nose, or throat
Tearing
Headache
Cough
Shortness of Breath
Chest Tightness / Pressure
Nausea / Vomiting
Dizziness
Weakness

Delayed Symptoms:

Weakness
Nausea / Vomiting
Shortness of Breath
Cough
Loss of Appetite
Abdominal Pain
Headache
Numbness / Tingling

IV. Present Status of Symptoms (check off appropriate symptoms)

Burning of eyes, nose, or throat
Tearing
Headache
Cough
Shortness of Breath
Chest Tightness / Pressure
Cyanosis
Nausea / Vomiting
Dizziness
Weakness
Loss of Appetite
Abdominal Pain
Numbness / Tingling

Have symptoms: (please check off appropriate response and give duration of symptoms)

Improved: ________ Worsened: ________ Remained Unchanged: ________

V. Treatment of Symptoms (check off appropriate response)

None: ________ Self-Medicated: ________ Physician Treated: ________

In the event that site personnel cannot mitigate the hazardous situation, the FOL and SSO will enact emergency notification procedures to secure additional assistance in the following manner:

- Dial 911 (outside services) and call other pertinent emergency contacts listed in Table 2-1 and report the incident. Give the emergency operator the location of the emergency, the type of emergency, the number of injured, and a brief description of the incident. Stay on the phone and follow the instructions given by the operator. The operator will then notify and dispatch the proper emergency response agencies.

2.7 PPE AND EMERGENCY EQUIPMENT

A first-aid kit, eye wash units (or bottles of disposable eyewash solution) and fire extinguisher(s) (strategically placed) will be maintained onsite and shall be immediately available for use in the event of an emergency. This equipment will be located in the field office as well as in each site vehicle. At least one first aid kit supplied with equipment to protect against bloodborne pathogens will also be available on site. Personnel identified within the field crew with bloodborne pathogen and first-aid training will be the only personnel permitted to offer first-aid assistance.

2.8 EMERGENCY CONTACTS

Prior to initiating field activities, all personnel will be thoroughly briefed on the emergency procedures to be followed in the event of an accident. Table 2-1 provides a list of emergency contacts and their associated telephone numbers. This table must be posted where it is readily available to all site personnel. Facility maps should also be posted showing potential evacuation routes and designated meeting areas.

2.9 EMERGENCY ROUTE TO HOSPITAL

Directions to Santa Rosa Medical Center (Primary Hospital)

> Travel 1 mile west of the base on Highway 87A, turn left. Drive 5.5 miles south on Highway 89 to Berry Hill Road, turn right. Travel 1.7 miles and the hospital is on the right.

Prior to site mobilization for field activities, a legible map indicating the travel route from the site to the Medical Center will be obtained and inserted as Figure 2-2 of this HASP.

Directions to West Florida Regional Medical Center (Alternate Hospital)

Travel 1 mile west from the base on Highway 87A, turn left. Drive 6 miles south on Highway 89 to Highway 90. Turn right and travel 13 miles to Davis Parkway (veer to the left). Travel 2.2 miles and the hospital is on the right side of the parkway. Exit Base onto Red Bank Road heading northwest. Take Snake River Road to Goose Creek Road. Turn left onto Goose Creek Road. Turn right on University Boulevard and follow to Medical Center. Take directions to Columbia Trident Medical Center. Exit onto I-26 south from University Boulevard. Take I-26 south approximately 4 miles to the Speisbegger Road exit and follow signs to the hospital.

Any pertinent information regarding allergies to medications or other special conditions will be provided to medical services personnel. This information is listed on Medical Data Sheets filed onsite. If an exposure to hazardous materials has occurred, provide hazard information from Table 6-1 to medical service personnel.

Figure 2-2 Route to Medical Center

3.0 SITE BACKGROUND

3.1 SITE INFORMATION

NAS Whiting Field is located in Santa Rosa County, approximately 20 miles northeast of Pensecola, in Milton, Florida. The Air Station, which is divided into two areas, provides support and facilities for flight and academic training. The North Field is used for fixed wing training, while the South Field is used for helicopter flight instruction.

3.2 SITE HISTORY AND CURRENT OPERATIONS

The air station was commissioned in 1943 as a training facility and has since generated waste streams associated with the operation and maintenance of aircraft, pilot scenario training exercises, and facility maintenance activities. Prior to the establishment of hazardous waste management and recycling plans, most of these materials were disposed of onsite. Wastes were either placed in onsite disposal pits or in waste oil bowsers, which were often used for firefighting training.

The industrial operations at Whiting Field include the North Field, South Field, and Mid Field areas. The North Field of NAS Whiting provided Primary flight training until 1949. Jet training was then introduced and several types of fixed wing aircraft were used until 1983. Maintenance and repair of these aircraft included stripping, painting, washing, and engine upkeep. These activities generated stripping compounds, cleaning solvents, paint wastes, alkaline cleaners, detergents, oil, and hydraulic fluids. In the 1970's, NAS Whiting Field began to perform general aircraft maintenance duties for Air Wing Five, a unit stationed at Whiting. The types of waste generated include waste oil, mineral spirits, methyl ethyl ketone (MEK), isopropyl alcohol, mixed paint thinners, and aircraft cleaning solution.

Line maintenance on transient aircraft and the daily upkeep and maintenance of several assigned aircraft has been performed at the Mid-Field Hanger since the 1940's. Operation and maintenance activities performed and the wastes generated at the Mid Field are similar to those generated at the North Field.

The South Field of NAS Whiting, provided aircraft flight training until the early 1970's. In 1972, fixed wing aircraft training was moved from the South Field to the North Field and helicopter training was initiated. Operation and maintenance activities performed on the helicopters were similar to those performed on fixed wing aircraft at the North Field. Wastes generated at the South Field were similar to those generated at the North Field.

In 1985, an initial site assessment was performed which indicated that thousands of gallons of waste including paints, paint thinners, solvents, waste oils, gasoline, hydraulic fluids, aviation gasoline (AVGAS), tank bottom sludges, transformer fluids containing polychlorinated biphenyls (PCBs), and paint stripping wastewater, were potentially dumped into onsite disposal areas. Additional wastes were reportedly released as a result of accidents or equipment failure. The assessment identified 16 disposal and/or spill areas located on the facility property.

3.3 INVESTIGATION AREAS

To provide confidence that potential contamination has been identified and to verify the Conceptual Site Model for groundwater and surface soil at NAS Whiting Field, investigation activities will be conducted at the following sites (including site concerns):

- Site 29, Auto Hobby Shop (paint, oil, and solvents)
- Site 36, Auto Repair Booth, Building 1440A (oil, grease, fuel, and solvents)
- Site 38, Golf Course Maintenance Building, Building 2877 (metals, solvents, grease, and pesticides)
- Site 39, Clear Creek Floodplain (solvents, oil, and fuels)
- Site 40, Basewide Groundwater (all chemicals of interest at NAS Whiting Field)
- PSC 1485C, Pesticide Storage Building 1485C (pesticides)
- Site 7, South AVGAS Tank Sludge Disposal Area (fuels)

4.0 SCOPE OF WORK

This section describes the project tasks that will be performed at NAS Whiting Field. Additionally, each task has been evaluated and the associated hazards and recommended control measures are listed in Table 5-1 of this HASP. The planned activities involved in this effort are presented in detail in the Work Plan developed for the project. If new tasks are to be performed at the site, Table 5-1 and this section will be modified accordingly.

Field investigations to be performed by TtNUS are designed to characterize soil, sediment, surface water, and groundwater conditions at NAS Whiting Field. Specific tasks to be conducted include, but are not necessarily limited to, the following:

- Soil borings (using Direct Push Technology and hollow-stem augers)
- Multi-media sampling (soil, sediment, surface water, and groundwater sampling)
- Monitoring well installation, development, and purging
- Decontamination of sampling and heavy equipment
- IDW management
- Mobilization and demobilization

The above listing represents a summarization of the tasks as they apply to the scope and application of this HASP. For more detailed description of the associated tasks, refer to the Field Sampling Plan (FSP) and/or the Work Plan (WP). If additional tasks are determined to be necessary, this HASP will be amended and a hazard evaluation of the additional tasks performed. The specific tasks to be performed at each site during the investigation are shown in Table 4-1.

TABLE 4-1

SITE ACTIVITY SUMMARY

Activity	Site 29	Site 36	Site 38	Site 39	Site 40	PSC 1485C	Site 7
Mobilization/Demobilization	X	X	X	X	X	X	X
Soil Boring Installation using HSA					X		
Soil Boring Installation using DPT	X	X	X	X		X	X
Monitoring Well Installation	X	X	X	X	X	X	
Monitoring Well Purging and Development	X	X	X	X	X	X	X
Groundwater Sampling			X	X	X	X	X
Surface Water Sampling				X			
Surface and Subsurface Soil Sampling	X	X	X			X	X
Sediment Sampling				X			
Decontamination of Sampling and Heavy Equipment	X	X	X	X	X	X	X
IDW Management	X	X	X	X	X	X	X
Surveying	X	X	X	X	X	X	X

5.0 TASKS/HAZARDS/ASSOCIATED CONTROL MEASURES SUMMARIZATION

Table 5-1 of this section serves as the primary portion of the site-specific HASP which identifies the tasks that are to be performed as part of the scope of work. This table will be modified and incorporated into this document as new or additional tasks are performed at the site. The anticipated hazards, recommended control measures, air monitoring recommendations, required Personal Protective Equipment (PPE), and decontamination measures for each site task are discussed in detail. This table and the associated control measures shall be changed, if the scope of work, contaminants of concern, or other conditions change.

Through using the table, site personnel can determine which hazards are associated with each task and at each site, and what associated control measures are necessary to minimize potential exposure or injuries related to those hazards. The table also assists field team members in determining which PPE and decontamination procedures to use based on proper air monitoring techniques and site-specific conditions.

As discussed earlier, a Health and Safety Guidance Manual accompanies this table and HASP. The manual is designed to further explain supporting programs and elements for other site -specific aspects as required by 29 CFR 1910.120. The Guidance Manual should be referenced for additional information regarding air monitoring instrumentation, decontamination activities, emergency response, hazard assessments, hazard communication and hearing conservation programs, medical surveillance, PPE, respiratory protection, site control measures, standard work practices, and training requirements. Many of Tetra Tech NUS' SOPs are also provided in this Guidance Manual.

Safe Work Permits issued for all exclusion zone activities (See Section 10.10) will use elements defined in Table 5-1 as it's primary reference. The FOL and/or the SSO completing the Safe Work Permit will add additional site-specific information. In situations where the Safe Work Permit is more conservative than the direction provided in Table 5-1 due to the incorporation of site-specific elements, the Safe Work Permit will be followed.

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TABLE 5-1
TASKS/HAZARDS/CONTROL MEASURES COMPENDIUM FOR NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring	Personal Protective Equipment	Decontamination Procedures
Soil borings using Direct-Push Technology (DPT, such as the Geoprobe®) and hollow-stem augers. This task also includes monitoring well installation, development, and purging.	*Chemical Hazards* 1) Primary contaminants include VOCs (represented as gasoline and trichloroethylene) and SVOCs (represented as waste oils, diesel fuel, and naphthalene), metals (represented as lead), and pesticides (represented as chlordane and DDT). Note that some of these contaminants are solids or that these contaminants may be bound to particulates (dusts, soils, etc.), and contact should be avoided whenever possible. None of the site contaminants, however, are anticipated to be present in significant concentrations to present an inhalation hazard. See Table 6-1 for more information on the chemicals of concern. 2) Transfer of contamination into clean areas or onto persons *Physical hazards* 3) Heavy equipment hazards (pinch/compression points, rotating equipment, hydraulic lines, etc.) 4) Noise in excess of 85 dBA 5) Energized systems (contact with underground or overhead utilities) 6) Lifting (strain/muscle pulls). 7) Slip, trips, and falls 8) Vehicular and foot traffic 9) Ambient temperature extremes (heat stress) *Natural hazards* 10) Insect/animal bites and stings, poisonous plants, etc.	1) Use real-time monitoring instrumentation, action levels, and identified PPE to control exposures to potentially contaminated media (air, water, soils, etc.). Generation of dusts should be minimized to the greatest extent possible. If airborne dusts are observed, area wetting methods will be used. If area wetting methods are not feasible, termination of activities will be used to minimize exposure to excessive airborne dusts. 2) Decontaminate all equipment and supplies between boreholes and prior to leaving the site. 3) All equipment to be used will be - Inspected in accordance with Federal safety and transportation guidelines, OSHA (1926.600,.601,.602), and manufacturers design and documented as such using Equipment Inspection Sheet (see Attachment III of this HASP). - Operated by knowledgeable operators and ground crew. - Only manufacturer approved equipment may be used in conjunction with equipment repair procedures In addition to the equipment considerations, the following standard operating procedures will be employed: - All personnel not directly supporting the direct push operation will remain at least 25 feet from the point of operation. - All loose clothing/protective equipment will be secured to avoid possible entanglement. - Hand signals will be established prior to the commencement of direct push activities. - A remote sampling device must be used to sample drill cuttings near rotating tools. - Work areas will be kept clear of clutter. - All personnel will be instructed in the location and operations of the emergency shut off device(s). This device will be tested initially (and then periodically) to insure its operational status. - Areas will be inspected prior to the movement of direct push rigs and support vehicles to eliminate any physical hazards. This will be the responsibility of the FOL and/or SSO. 4) Hearing protection will be used during all subsurface activities. 5) All utility clearances shall be obtained, in writing, prior to subsurface activities (contact Jim Holland). Prior to any subsurface investigations, the locations of all underground utilities will be identified and marked. 6) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques. 7) Preview work locations for unstable/uneven terrain. 8) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e. Boom + 3 feet). - Secure all loose articles to avoid possible entanglement. - All equipment shall be equipped with movement warning systems. - All activities are to be conducted consistent with the Base requirements. 9) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding heat stress is provided in Section 4 of the TtNUS Health and Safety Guidance Manual and Attachment V of this HASP. 10) Avoid nesting areas, use repellents. Report potential hazards to the SSO. Follow guidance presented in Attachment II of this HASP.	**It is anticipated that potential contaminant concentrations at outdoor sample locations will not present an inhalation hazard.** A direct reading Photoionization Detector (PID) or Flameionization Detector (FID) will be used to screen samples and to detect the presence of any potential volatile organics. Source monitoring of the borehole will be conducted at regular intervals to be determined by the SSO. Positive sustained results at a source or downwind location(s) which may impact operations crew will require the following actions: - Monitor the breathing zone of at-risk and downwind employees. Any sustained readings (greater than 1 minute in duration) above 10 ppm in the breathing zone of the at-risk employees requires site activities to be suspended and site personnel to report to an unaffected area. - Work may only resume if airborne readings in worker breathing zone return to below 10 ppm levels. If elevated readings in worker breathing zone persist, the PHSO and HSM will be contacted to determine necessary actions and levels of protection. Some site contaminants are non-volatile or solids and will not be detectable using the PID or FID. Site contaminants may also adhere to or be part of airborne dusts or particulates generated during site activities. Generation of dusts should be minimized to the greatest extent possible to avoid inhalation of contaminated dusts or particulates. Evaluation of dust concentrations will be performed by observing work conditions for visible dust clouds. Potential exposure to contaminated dust will be controlled using water suppression, by avoiding dust plumes, or evacuating the operation area until dust subsides. Where the utility clearance cannot be determined, subsurface activities shall proceed with extreme caution using a magnetometer for periodic down-hole surveys every 2 feet to a depth of at least 10 feet.	All subsurface operations are to be initiated in Level D protection. Level D protection constitutes the following minimum protection - Standard field attire (Sleeved shirt; long pants) - Safety shoes (Steel toe/shank) - Safety glasses - Hardhat - Reflective vest for traffic areas - Tyvek coveralls and disposable boot covers if surface contamination is present or if the potential exists for soiling work attire. - Nitrile gloves or leather gloves with surgical style inner gloves - Hearing protection during drilling or for other high noise areas as directed by the SSO. **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task.	**Personnel Decontamination** - Will consist of a soap/water wash and rinse for reusable protective equipment (e.g., gloves). This function will take place at an area adjacent to the drilling operations bordering the support zone. This decontamination procedure for Level D protection will consist of - Equipment drop - Soap/water wash and rinse of reusable outer gloves, as applicable - Outer coveralls, boot covers, and/or outer glove removal - Removal, segregation, and disposal of non-reusable PPE in bags/containers provided - Wash hands and face, leave contamination reduction zone.

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TABLE 5-1
TASKS/HAZARDS/CONTROL MEASURES COMPENDIUM FOR NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring	Personal Protective Equipment	Decontamination Procedures
Multi-media sampling, including soil and groundwater sampling. This task also includes aquifer testing.	*Chemical Hazards* 1) Primary contaminants include VOCs (represented as gasoline and trichloroethylene) and SVOCs (represented as waste oils, diesel fuel, and naphthalene), metals (represented as lead), and pesticides (represented as chlordane and DDT). Note that some of these contaminants are solids or that these contaminants may be bound to particulates (dusts, soils, etc.), and contact should be avoided whenever possible. None of the site contaminants, however, are anticipated to be present in significant concentrations to present an inhalation hazard. See Table 6-1 for more information on the chemicals of concern. 2) Transfer of contamination into clean areas *Physical hazards* 3) Noise in excess of 85 dBA 4) Lifting (strain/muscle pulls) 5) Pinches and compressions 6) Slip, trips, and falls 7) Ambient temperature extremes (heat stress) 8) Vehicular and foot traffic *Natural hazards* 9) Insect/animal bites and stings, poisonous plants, etc.	1) Use real-time monitoring instrumentation, action levels, and identified PPE to control exposures to potentially contaminated media (e.g. air, water, soils). Generation of dusts should be minimized to the greatest extent possible. If airborne dusts are observed, area wetting methods will be used. If area wetting methods are not feasible, termination of activities will be used to minimize exposure to observed airborne dusts. 2) Decontaminate all equipment and supplies between sampling locations and prior to leaving the site. 3) When sampling at the Drill rig use hearing protection. The use of hearing protection outside of 25 feet from the Drill rig should be incorporated under the following condition: If you have to raise your voice to talk to someone who is within 2 feet of your location, hearing protection must be worn. 4) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques. 5) Keep any machine guarding in place. Avoid moving parts. Use tools or equipment where necessary to avoid contacting pinch points. - A remote sampling device must be used to sample drill cuttings near rotating tools. The equipment operator shall shutdown machinery if the sampler is near moving machinery parts. 6) Preview work locations for unstable/uneven terrain. 7) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding heat stress concerns is provided in Section 4 of the TtNUS Health and Safety Guidance Manual and Attachment V of this HASP. 8) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e. Boom + 3 feet). - Secure all loose articles to avoid possible entanglement. - All equipment shall be equipped with movement warning systems. - All activities are to be conducted consistent with the Base requirements. 9) Avoid nesting areas, use repellents. Report potential hazards to the SSO. Follow guidance presented in Attachment II of this HASP.	**It is anticipated that potential contaminant concentrations at outdoor sample locations will not present an inhalation hazard.** A direct reading Photoionization Detector (PID) or Flameionization Detector (FID) will be used to screen samples and to detect the presence of any potential volatile organics. Source monitoring of the borehole will be conducted at regular intervals to be determined by the SSO. Positive sustained results at a source or downwind location(s) which may impact operations crew will require the following actions: - Monitor the breathing zone of at-risk and downwind employees. Any sustained readings (greater than 1 minute in duration) above 10 ppm in the breathing zone of the at-risk employees requires site activities to be suspended and site personnel to report to an unaffected area. - Work may only resume if airborne readings in worker breathing zone return to below 10 ppm levels. If elevated readings in worker breathing zone persist, the PHSO and HSM will be contacted to determine necessary actions and levels of protection. Some site contaminants are non-volatile or solids and will not be detectable using the PID or FID. Site contaminants may also adhere to or be part of airborne dusts or particulates generated during site activities. Generation of dusts should be minimized to the greatest extent possible to avoid inhalation of contaminated dusts or particulates. Evaluation of dust concentrations will be performed by observing work conditions for visible dust clouds. Potential exposure to contaminated dust will be controlled using water suppression, by avoiding dust plumes, or evacuating the operation area until dust subsides.	Level D protection will be utilized for the initiation of all sampling activities. Level D - (Minimum Requirements) - Standard field attire (Sleeved shirt; long pants) - Safety shoes (steel toe/shank) - Safety glasses - Surgical style gloves (double-layered if necessary) - Reflective vest for high traffic areas - Hardhat (when overhead hazards exists, or identified as a operation requirement) - Tyvek coveralls and disposable boot covers if surface contamination is present or if the potential for soiling work attire exists. - Hearing protection for high noise areas, or as directed on an operation by operation scenario. **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task.	**Personnel Decontamination** will consist of a removal and disposal of non-reusable PPE (gloves, coveralls, etc., as applicable). The decon function will take place at an area adjacent to the site activities. This procedure will consist of: - Equipment drop - Outer coveralls, boot covers, and/or outer glove removal (as applicable) - Removal, segregation, and disposal of non-reusable PPE in bags/containers provided - Soap/water wash and rinse of reusable PPE (e.g., hardhat) if potentially contaminated - Wash hands and face, leave contamination reduction zone.

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring	Personal Protective Equipment	Decontamination Procedures
Mobilization/ Demobilization	*Physical Hazards* 1) Lifting (strain/muscle pulls) 2) Pinches and compressions 3) Slip, trips, and falls 4) Heavy equipment hazards (rotating equipment, hydraulic lines, etc.) 5) Vehicular and foot traffic 6) Ambient temperature extremes (heat stress) *Natural hazards* 7) Insect/animal bites and stings, poisonous plants, etc.	1) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques. 2) Keep any machine guarding in place. Avoid moving parts. Use tools or equipment where necessary to avoid contacting pinch points. 3) Preview work locations for unstable/uneven terrain. 4) All equipment will be - Inspected in accordance with OSHA and manufacturers design. - Operated by knowledgeable operators, and knowledgeable ground crew. 5) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e. Boom + 3 feet). - Secure all loose articles to avoid possible entanglement. - All equipment shall be equipped with movement warning systems. - All activities are to be conducted consistent with the Base requirements. 6) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding cold/heat stress concerns is provided in Section 4 of the TtNUS Health and Safety Guidance Manual and Attachment V of this HASP. 7) Avoid nesting areas, use repellents. Report potential hazards to the SSO. Follow guidance presented in Attachment II of this HASP.	Not required	Level D - (Minimum Requirements) - Standard field attire (Sleeved shirt; long pants) - Safety shoes (Steel toe/shank) - *Safety glasses* - *Hardhat (when overhead hazards exists, or identified as a operation requirement)* - *Reflective vest for high traffic areas* - *Hearing protection for high noise areas, or as directed on an operation by operation scenario.* *(Items in italics are deemed optional as conditions or the FOL or SSO dictate.)*	Not required
Decontamination of Sampling and Heavy Equipment	*Chemical Hazards* 1) Primary contaminants include VOCs (represented as gasoline and trichloroethylene) and SVOCs (represented as waste oils, diesel fuel, and naphthalene), metals (represented as lead), and pesticides (represented as chlordane and DDT). Note that some of these contaminants are solids or that these contaminants may be bound to particulates (dusts, soils, etc.), and contact should be avoided whenever possible. None of the site contaminants, however, are anticipated to be present in significant concentrations to present an inhalation hazard. See Table 6-1 for more information on the chemicals of concern. 2) Decontamination fluids - Liquinox (detergent), acetone or isopropanol *Physical Hazards* 3) Lifting (strains/muscle pulls) 4) Noise in excess of 85 dBA 5) Flying projectiles 6) Vehicular and foot traffic 7) Ambient temperature extremes (heat stress) 8) Slips, trips, and falls	1) and 2) Employ protective equipment to minimize contact with site contaminants and hazardous decontamination fluids. Obtain manufacturer's MSDS for any decontamination solvents used onsite. Use appropriate PPE as identified on MSDS. All chemicals used must be listed on the Chemical Inventory for the site, and site activities must be consistent with the Hazard Communication section of the Health and Safety Guidance Manual (Section 5). 3) Use multiple persons where necessary for lifting and handling sampling equipment for decontamination purposes. 4) Wear hearing protection when operating pressure washer. 5) Use eye and face protective equipment when operating pressure washer. All other personnel must be restricted from the area. 6) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e. Boom + 3 feet). - Secure all loose articles to avoid possible entanglement. - All equipment shall be equipped with movement warning systems. - All activities are to be conducted consistent with the Base requirements. 7) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding cold/heat stress concerns is provided in Section 4 of the TtNUS Health and Safety Guidance Manual and Attachment V of this HASP. 8) Preview work locations for unstable/uneven terrain.	Use visual observation, and real-time monitoring instrumentation to ensure all equipment has been properly cleaned of contamination and dried. After decon is completed, screen equipment with a PID/FID. If any elevated readings (i.e., above background) are observed, perform decon again and re-screen. Repeat until no elevated PID/FID readings are noted.	For Heavy Equipment This applies to high pressure soap/water, steam cleaning wash and rinse procedures. Level D Minimum requirements - - Standard field attire (Long sleeve shirt; long pants) - Safety shoes (Steel toe/shank) - Chemical resistant boot covers - Nitrile outer gloves - *PVC Rainsuits or PE or PVC coated Tyvek* - *Safety glasses underneath a splash shield* - *Hearing protection (plugs or muffs)* *Items in italics are at the discretion of the SSO.* For sampling equipment (trowels, MacroCore Samplers, bailers, etc.), the following PPE is required Level D Minimum requirements - - Standard field attire (Long sleeve shirt; long pants) - Safety shoes (Steel toe/shank) - Nitrile outer gloves - Safety glasses In the event of overspray of chemical decontamination fluid employ PVC Rainsuits or PE or PVC coated Tyvek as necessary.	**Personnel Decontamination** will consist of a soap/water wash and rinse for reusable outer protective equipment (boots, gloves, PVC splash suits, as applicable). The decon function will take place at an area adjacent to the site activities. This procedure will consist of: - Equipment drop - Soap/water wash and rinse of outer boots and gloves, as applicable - Soap/water wash and rinse of the outer splash suit, as applicable - Disposable PPE will be removed and bagged. **Equipment Decontamination** - All heavy equipment decontamination will take place at a centralized decontamination pad utilizing steam or pressure washers. Heavy equipment will have the wheels and tires cleaned along with any loose debris removed, prior to transporting to the central decontamination area. All site vehicles will be restricted access to exclusion zones, or also have their wheels/tires sprayed off as not to track mud onto the roadways servicing this installation. Roadways shall be cleared of any debris resulting from the onsite activity. **Sampling Equipment Decontamination** Sampling equipment will be decontaminated as per the requirements in the Sampling and Analysis Plan and/or Work Plan. MSDS for any decon solutions (Alconox, isopropanol, etc.) will be obtained and used to determine proper handling / disposal methods and protective measures (PPE, first-aid, etc.). All equipment used in the exclusion zone will require a complete decontamination between locations and prior to removal from the site. The FOL or the SSO will be responsible for evaluating equipment arriving onsite and leaving the site. No equipment will be authorized access or exit without this evaluation.

TABLE 5-1
TASKS/HAZARDS/CONTROL MEASURES COMPENDIUM FOR NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring	Personal Protective Equipment	Decontamination Procedures
IDW management and moving IDW drums to storage areas	*Chemical Hazards* 1) Primary contaminants include VOCs (represented as gasoline and trichloroethylene) and SVOCs (represented as waste oils, diesel fuel, and naphthalene), metals (represented as lead), and pesticides (represented as chlordane and DDT). Note that some of these contaminants are solids or that these contaminants may be bound to particulates (dusts, soils, etc.), and contact should be avoided whenever possible. None of the site contaminants, however, are anticipated to be present in significant concentrations to present an inhalation hazard. See Table 6-1 for more information on the chemicals of concern. 2) Transfer of contamination into clean areas *Physical hazards* 3) Noise in excess of 85 dBA 4) Lifting (strains/muscle pulls) 5) Pinches and compressions 6) Slip, trips, and falls 7) Vehicular and foot traffic 8) Ambient temperature extremes (heat stress) *Natural hazards* 9) Insect/animal bites and stings, poisonous plants, etc.	1) Employ real-time monitoring instrumentation, action levels, and identify PPE to control exposures to potentially contaminated media (e.g. air, water, soils). 2) Decontaminate all equipment and supplies, if they become contaminated, between locations and prior to leaving the site. 3) When working near heavy equipment, use hearing protection. 4) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques. 5) Keep any machine guarding in place. Avoid moving parts. Use tools or equipment where necessary to avoid contacting pinch points. 6) Preview work locations for unstable/uneven terrain. 7) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e. Boom + 3 feet). - Secure all loose articles to avoid possible entanglement. - All equipment shall be equipped with movement warning systems. - All activities are to be conducted consistent with the Base requirements. 8) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding cold/heat stress concerns is provided in Section 4 of the TtNUS Health and Safety Guidance Manual and Attachment V of this HASP. 9) Avoid nesting areas, use repellents. Report potential hazards to the SSO. Follow guidance presented in Attachment II of this HASP.	**It is anticipated that potential contaminant concentrations at outdoor sample locations will not present an inhalation hazard.** A direct reading Photoionization Detector (PID) or Flameionization Detector (FID) will be used to screen samples and to detect the presence of any potential volatile organics. Source monitoring of the borehole will be conducted at regular intervals to be determined by the SSO. Positive sustained results at a source or downwind location(s) which may impact operations crew will require the following actions: - Monitor the breathing zone of at-risk and downwind employees. Any sustained readings (greater than 1 minute in duration) above 10 ppm in the breathing zone of the at-risk employees requires site activities to be suspended and site personnel to report to an unaffected area. - Work may only resume if airborne readings in worker breathing zone return to below 10 ppm levels. If elevated readings in worker breathing zone persist, the PHSO and HSM will be contacted to determine necessary actions and levels of protection. Some site contaminants are non-volatile or solids and will not be detectable using the PID or FID. Site contaminants may also adhere to or be part of airborne dusts or particulates generated during site activities. Generation of dusts should be minimized to the greatest extent possible to avoid inhalation of contaminated dusts or particulates. Evaluation of dust concentrations will be performed by observing work conditions for visible dust clouds. Potential exposure to contaminated dust will be controlled using water suppression, by avoiding dust plumes, or evacuating the operation area until dust subsides.	Level D protection will be utilized for the initiation of all sampling activities. Level D - (Minimum Requirements) - Standard field attire (long sleeve shirt; long pants) - Tyvek coveralls and disposable boot covers if surface contamination is present or if the potential for soiling work attire exists. - Cotton/leather work gloves with surgical style inner gloves - Safety shoes (steel toe/shank) - Safety glasses - Hardhat (when overhead hazards exists, or identified as a operation requirement) - Reflective vest for high traffic areas - Hearing protection for high noise areas, or as directed on an operation by operation scenario.	**Personnel Decontamination** will consist of a soap/water wash and rinse for reusable outer protective equipment (boots, gloves, PVC splash suits, as applicable). The decon function will take place at an area adjacent to the site activities. This procedure will consist of: - Equipment drop - Soap/water wash and rinse of outer boots and gloves, as applicable - Soap/water wash and rinse of the outer splash suit, as applicable - Disposable PPE will be removed and bagged.

6.0 HAZARD ASSESSMENT

The following section provides information regarding the chemical, physical, and biological hazards anticipated to be present during the activities to be conducted. Table 6-1 provides information related to chemical constituents that have been identified by analysis or are suspected to be present at the various sites based on historical data. Specifically, toxicological information, exposure limits, symptoms of exposure, physical properties, and air monitoring and sampling data are discussed in the table.

6.1 CHEMICAL HAZARDS

The potential health hazards associated with NAS Whiting Field include inhalation, ingestion, and dermal contact of various contaminants that may be present in shallow and deep soils, sediments, surface water, and groundwater. As the focus of this field investigation is to conduct additional sampling of various media at the associated sites, concentrations of the chemical hazards present are not fully determined. Based on prior activities at the sites; however, the types of contaminants anticipated include oils, fuels, solvents, and pesticides. The following have been identified as the primary classes of hazards for these contaminants:

- Volatile Organic Compounds (VOCs), represented as gasoline and trichloroethylene (TCE)
- Semi-Volatile Organic Compounds (SVOCs), including Total Petroleum Hydrocarbons (TPH's), represented as waste oils, diesel fuel, and naphthalene
- Metals, represented as lead
- Pesticides, represented as chlordane and DDT (and major metabolites DDD and DDE)

Table 6-1 provides information on the individual substances likely to be present at the sites of concern. Included is information on the toxicological, chemical, and physical properties of these substances. It is anticipated that the greatest potential for exposure to site contaminants is during intrusive activities (drilling, soil sampling, etc.). Exposure to these compounds is most likely to occur through ingestion and inhalation of contaminated soil or water, or hand-to-mouth contact during soil disturbance activities. For this reason, PPE and basic hygiene practices (washing face and hands before leaving site) will be extremely important. Inhalation exposure will be avoided by using appropriate PPE and engineering controls where necessary. Exposure via inhalation is not anticipated during the planned scope of work.

TABLE 6-1
CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

Substance	CAS No.	Air Monitoring/Sampling Information		Exposure Limits	Warning Property Rating	Physical Properties	Health Hazard Information
Diesel Fuel No.2-D	Mixture	Components of this substance will be detected readily; however, no documentation exists as to the relative response ratio of either PID or FID.	Air sampling use charcoal tube as a collection media; carbon disulfide desorption; GC/FID detection. Sampling and analytical protocol in accordance with NIOSH Method #1550.	OSHA; NIOSH; ACGIH: 5 mg/m^3 as mineral oil mist. In addition NIOSH and ACGIH establish 10 mg/m^3 as a STEL.	Kerosene odor **Recommended air-purifying cartridges:** Organic vapor **Recommended gloves:** Nitrile	**Boiling Pt:** <300-550°F; 149-288°C **Melting Pt:** Not available **Solubility:** Negligible **Flash Pt:** 95-145°F; 35-62°C **Autoignition:** 475°F, 246°C **LEL/LFL:** 0.6% **UEL/UFL:** 8.0% **Vapor Density:** >5 **Vapor Pressure:** <0.1 mmHg @ 70°F; 21°C **Specific Gravity:** 0.80 **Incompatibilities:** strong oxidizers, halogens, and hypochlorites **Appearance and odor:** Colorless to amber with a kerosene odor	Prolonged or repeated exposures to this product may cause skin and eye irritation. Because of the defatting capabilities ,this exposure may lead to a dermatitis condition. High vapor concentrations are irritating to the eyes and respiratory tract. Exposure to high airborne concentrations may result in narcotic effects, including dizziness, headaches, and anesthetic to unconsciousness. High concentrations in a confined space may adequately displace oxygen thereby resulting in suffocation.
Trichloroethylene	79-01-6	PID: I.P. 9.45 eV, High response with PID and 10.2 eV lamp. FID: 70% Response with FID.	Air sample using charcoal tube; carbon disulfide desorption; Sampling and analytical protocol shall proceed in accordance with OSHA Method #07, or NIOSH Method #1022 or #1003.	OSHA: 50 ppm 200 ppm (Ceiling) ACGIH: 50 ppm 100 ppm STEL NIOSH: 25 ppm IDLH: 1000 ppm	Inadequate - Odor threshold 82 ppm. APRs with organic vapor/acid gas cartridges may be used for escape purposes. Exceedances over the exposure limits require the use of positive pressure-demand supplied air respirator. **Recommended gloves:** PV Alcohol unsupported >16.00 hrs; Silver shield >6.00 hrs; Teflon >24.00 hrs; or Viton >24.00 hrs; Nitrile (Useable time limit 0.5 hr, complete submersion for the nitrile selection)	**Boiling Pt:** 188°F; 86.7°C **Melting Pt:** -99°F; -73°C **Solubility:** 0.1% @ 77°F; 25°C **Flash Pt:** 90°F; 32°C **LEL/LFL:** 8% @ 77°F; 25°C **UEL/UFL:** 10.5 @ 77°F; 25°C **Vapor Density:** 4.53 **Vapor Pressure:** 100 mmHg @ 90°F; 32° C **Specific Gravity:** 1.46 **Incompatibilities:** Strong caustics and alkalis, chemically active metals (barium, lithium, sodium, magnesium, titanium, and beryllium) **Appearance and Odor:** Colorless liquid with a chloroform type odor. Combustible liquid, however, burns with difficulty.	Central nervous system effects including euphoria, analgesia, anesthesia, paresthesia, headaches, tremors, vertigo, and somnolence. Damage to the liver, kidneys, heart, lungs, and skin have also been reported. Contact may result in irritation to the eyes, skin, and mucous membranes. Ingestion may result in GI disturbances including nausea, and vomiting NIOSH lists this substance a potential human carcinogen.
Gasoline	8006-61-9	Relative response ratios for the components of gasoline range from 100 - 200% for PID and FID detection.	See components for measurement considerations.	ACGIH & OSHA: 300 ppm 500 ppm STEL NIOSH: Reduce to lowest feasible concentration.	**Respiratory Protection:** Odor threshold 0.7 ppm, adequate air purifying respirator with organic vapor cartridges up to 100 ppm. **Recommended Gloves:** Nitrile >6.00 hrs; PV alcohol >6.00 hrs; Viton/neoprene >8.00 hrs	**Boiling Pt:** 102°F; 39°C **Melting Pt:** Not available **Solubility:** Negligible **Flash Pt:** -50°F; -45°C **LEL/LFL:** 1.4% **UEL/UFL:** 7.6% **Vapor Density:** ~5 **Vapor Pressure:** 38-300 mmHg (varies seasonally) **Specific Gravity:** 0.74 @ 20/20°C **Incompatibilities:** Strong oxidizers, peroxides, strong acids, and perchlorates **Appearance and Odor:** Colorless liquid with gasoline odor.	Overexposure to this substance may result in irritation to the eyes, skin, and mucous membranes. Systemically, headache, fatigue, blurred vision, dizziness, slurred speech, confusion, possible convulsion, and chemical pneumonia (aspiration). Prolonged or chronic exposures may result in possible liver or kidney damage. Components of this substance have been determined to be confirmed human carcinogens.

TABLE 6-1
CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA
NAVAL AIR STATION WHITING FIELD
PAGE 2

Substance	CAS No.	Air Monitoring/Sampling Information		Exposure Limits	Warning Property Rating	Physical Properties	Health Hazard Information
Lead	7439-92-1	Particulate form - Unable to be detected by either PID or FID.	Air sample using a mixed cellulose ester filter; or HNO_3 or H_2O_2 desorption; or Atomic absorption detection. NIOSH Method #7082 or #7300.	OSHA: 0.05 mg/m³ ACGIH: 0.05 mg/m³ NIOSH: 0.10 mg/m³ IDLH: 100 mg/m³ as lead	The use of a air purifying, full-face respirator with high efficiency particulate air filter for up to 2.5 mg/m³. **Recommended gloves:** This is in the particulate form. Therefore any glove suitable to prevent skin contact (Nitrile has been the one most widely used for the other substances).	**Boiling Pt:** 3164°F; 1740°C **Melting Pt:** 621°F; 327°C **Solubility:** Insoluble **Flash Pt:** Not applicable (Airborne dust may burn or explode when exposed to heat, flame, or incompatible chemicals) **LEL/LFL:** Not applicable **UEL/UFL:** Not applicable **Vapor Density:** Not available **Vapor Pressure:** 0 mmHg **Specific Gravity:** 11.34 **Incompatibilities:** Strong oxidizers, peroxides, sodium acetylide, zirconium, and acids **Appearance and Odor:** Metal: A heavy ductile, soft gray solid.	Overexposure to this substance via ingestion or inhalation may result in metallic taste in the mouth, dry throat, thirst, Gastrointestinal disorders (burning stomach pain, nausea, vomiting, possible diarrhea sometimes bloody or black, accompanied by severe bouts of colic), CNS effects (muscular weakness, pain, cramps, headaches, insomnia, depression, partial paralysis possibly coma and death. Extended exposure may result in damage to the kidneys, gingival lead line, brain, and anemia.
Chlordane	57-74-9	Substance is not volatile (VP=.00001 mmHg) I.P. is unknown, therefore detection by PID is unknown. Substance is non-combustible, therefore a FID is not expected to have a response to chlordane.	Air sample using Chromosorb-102 sorbent tube with mixed cellulose-ester filter or a xad-2 sorbent tube with filter. Toluene desorption and analysis by gas chromatography-electron capture detector. Sampling and analytical protocol will proceed in accordance with NIOSH Method #5510 or OSHA Method #67.	OSHA; NIOSH; ACGIH: 0.5 mg/m³	Adequate - can use an air purifying respirator with an organic vapor & high efficiency air filter cartridges. **Recommended gloves:** PTFE Teflon for pure product. Nitrile acceptable for incidental contact.	**Boiling Pt:** 347°F; 175°C **Melting Pt:** Not available **Solubility:** Insoluble **Flash Pt:** Not available **LEL/LFL:** Not available **UEL/UFL:** Not available **Vapor Density:** Not available **Vapor Pressure:** 0.00001 mmHg **Specific Gravity:** 1.56 @ 60°F; 15.5°C **Incompatibilities:** Strong oxidizers and alkaline reagents **Appearance and Odor:** Amber-colored, viscous liquid with a pungent, chlorine like odor.	Earliest signs of overexposure manifest as hypersensitivity of the central nervous system characterized by hyperactive reflexes, muscle twitching, tremors, incoordination, ataxia, and clonic convulsions. Cycles of excitement and depression may be repeated over and over. Chronic health hazard information similar to those for DDT.
DDT and the major metabolites; DDD and DDE.	50-29-3 72-54-8 72-55-9	Substance is not volatile, I.P. is unknown, detection by PID is unknown. Substance non-combustible, therefore a FID is anticipated to have reduced response to DDT.	Air sample using a binder free, glass fiber filter; isoctane desorption; gas chromatography-electron capture detector. Sampling and analytical protocol will proceed in accordance with NIOSH Method #3(S274).	OSHA; ACGIH: 1 mg/m³ NIOSH: 0.5 mg/m³	Adequate - Can use air purifying respirator with high efficiency particulate air filter (HEPA). **Recommended glove:** Nitrile acceptable for incidental contact.	**Boiling Pt:** 230°F; 110°C **Melting Pt:** 226°F; 108°C **Solubility:** Insoluble **Flash Pt:** 162-171°F; 72-77°C **LEL/LFL:** Not available **UEL/UFL:** Not available **Vapor Density:** Not available **Vapor Pressure:** Low **Specific Gravity:** 0.99 **Incompatibilities:** Strong oxidizers and alkalis **Appearance and Odor:** Colorless crystals or off-white powder with a slight aromatic odor	Acute overexposure may cause numbness and parethesias of the lips, tongue, and face associated with malaise, headache, sorethroat, fatigue and weakness. This may be accompanied by confusion, apprehension, and depression. Convulsions may result and death may occur from respiratory failure. DDT is absorbed and retained in the fat of humans. Chronic exposure may result in damage to the liver, kidneys and Peripheral Nervous System. DDT is recognized as possessing carcinogenic properties by IARC and NTP.

TABLE 6-1
CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA
NAVAL AIR STATION WHITING FIELD
PAGE 3

Substance	CAS No.	Air Monitoring/Sampling Information		Exposure Limits	Warning Property Rating	Physical Properties	Health Hazard Information
Waste Oils All information is based on mineral oil	Mixture N.E. 8012-95-1 for mineral oil	Varies between fractions however waste oils tend to be less volatile. The FID tends to handle the longer chained aliphatic hydrocarbons more efficiently than its PID counterpart and would be selected as the instrument of choice.	Sampling and analytical protocol shall be in accordance with NIOSH Method #5026 (the recommended method for mineral oil mist).	ACGIH; NIOSH: 5 mg/m³ (oil mists); 10 mg/m³ STEL. OSHA; 5 mg/m³ (Oil mists)	Non-volatile substance, therefore no respiratory protection is required. In an aerosol form, dust and mist respirator would be considered acceptable for up to 500 mg/m³. **Recommended gloves: Any glove suitable to prevent skin contact (Nitrile has been the one most widely used for the other substances, and will be acceptable). Natural rubber gloves should be avoided.** **Recommended gloves:** Nitrile	**Boiling Pt:** 680°F; 360°C **Melting Pt:** Not available **Solubility:** Insoluble **Flash Pt:** 275-500°F; 135-260°C depends on the distillation fraction **LEL/LFL:** Not available **UEL/UFL:** Not available **Vapor Density:** Not available **Vapor Pressure:** <0.5 mmHg **Specific Gravity:** 0.90 **Incompatibilities:** None reported **Appearance and odor:** Colorless, oily, with an odor of burned lubricating oil.	Minor irritation to the eyes, skin, and respiratory system.
Naphthalene	91-20-3	PID: I.P 8.12 eV, relative response ratio unknown. No information was found as to the relative response for the FID, however it is certain it is detectable at a high response.	Air sample using charcoal tube and carbon disulfide desorption; GC/FID detection. Sampling and analytical protocol in accordance with OSHA Method # 35 or NIOSH Method #1501	OSHA; ACGIH; NIOSH; 10 ppm NIOSH; ACGIH: have established an STEL of 15 ppm. IDLH: 250 ppm	Odor threshold 0.38 ppm, Adequate- Use an air purifying respirator with organic vapor cartridges for concentrations up to 250 ppm. **Recommended gloves:** Nitrile - >6.00 hrs; Neoprene - >6.00 hrs;	**Boiling Pt:** 424°F; 218°C **Melting Pt:** 176°F; 80°C **Solubility:** 0.003% **Flash Pt:** 174°F; -79°C **LEL/LFL:** 0.9% **UEL/UFL:** 5.9% **Vapor Density:** Not available **Vapor Pressure:** 1 mmHg **Specific Gravity:** 1.15 **Incompatibilities:** Strong oxidizers, chromic anhydride **Appearance and Odor:** Colorless to brown solid with an odor of mothballs	Overexposure may result in irritation to the eyes, headache, confusion, excitement, nausea, vomiting, abdominal pain, irritation of the bladder, profuse sweating, jaundice, blood in the urine, renal failure (kidney shutdown), and dermatitis. Prolonged or chronic exposure may further cause optical neuritis, and corneal damage. Target organs area listed as eyes, blood, cells, and central nervous system.

6.2 PHYSICAL HAZARDS

The physical hazards that may be present during the performance of site activities are summarized below:

- Heavy equipment hazards (pinch/compression points, rotating equipment, etc.)
- Slips, trips, and falls
- Energized systems (contact with underground or overhead utilities)
- Lifting (strain/muscle pulls)
- Noise in excess of 85 decibels (dBA)
- Pinches and compressions
- Inclement weather
- Ambient temperature extremes (heat stress)
- Flying projectiles
- Vehicular and foot traffic

These physical hazards are discussed in Table 5-1 as applicable to each site task. Further, many of these hazard are discussed in detail in Section 4.0 of the Health and Safety Guidance Manual. Specific discussion on some of these hazards is presented below.

6.2.1 Heavy Equipment Hazards (Pinch/compression points, rotating equipment, etc.)

Often the hazards associated with drilling operations are the most dangerous to be encountered during site activities. The SSO will thoroughly discuss safe drilling procedures during the pre-activities training session. All site personnel will sign the form in Figure 8-2 documenting that they received the training and understand the procedures. The following rules will apply to all drilling operations:

- Each rig must be equipped with emergency stop devices which will be tested daily to ensure that they are operational.

- Long handled shovels or equivalent shall be used to clear cuttings from the borehole and rotating equipment.

- The driller may not leave the controls when the augers are rotating.

6.2.2 Energized Systems (Contact with Underground or Overhead Utilities)

Underground utilities such as pressurized lines, water lines, telephone lines, buried utility lines, and high voltage power lines are known to be present throughout the facility. Clearance of underground and overhead utilities for each sample location will be coordinated with NAS Whiting Field personnel. Jim Holland is the point of contact for utilities clearance and can be reached at (850) 623-7181 ext. 149. Additionally, drilling operations will be conducted at a safe distance (>20 feet) from overhead power lines. Whenever underground utilities are suspected to be close to subsurface sampling locations, the borehole will be advanced to a minimum of 5.0 feet with a hand auger prior to drilling. As built drawings may also be utilized for additional clarification. In certain cases, Base personnel may need to deenergize electrical cables using facility lockout/tagout procedures to insure electrical hazards are eliminated.

6.2.3 Inclement Weather

Many of the project tasks under this Scope of Work will be performed outdoors. As a result, inclement weather may be encountered. In the event that adverse weather (electrical storms, hurricanes, etc.) conditions arise, the FOL and/or the SSO will be responsible for temporarily suspending or terminating activities until hazardous conditions no longer exist.

6.2.4 Ambient Temperature Extremes

Overexposure to high ambient temperatures (heat stress) may exist during performance of this work depending on the project schedule. Extremely cold temperatures are not expected to be encountered due to project location. Work performed when ambient temperatures exceed 70°F may result in varying levels of heat stress (heat rash, heat cramps, heat exhaustion, and/or heat stroke) depending on variables such as wind speed, humidity, and percent sunshine, as well as physiological factors such as metabolic rate and skin moisture content. Additionally, work load and level of protective equipment will affect the degree of exposure. Site personnel will be encouraged to drink plenty of fluids to replace those lost through perspiration. Additional information such as Work-Rest Regimens and personnel monitoring may be found in Section 4.0 of the Health & Safety Guidance Manual and Attachment V of this HASP. The SSO will recommend additional heat stress control measures as they are deemed necessary per ACGIH guidelines.

6.3 NATURAL HAZARDS

Natural hazards such as poisonous plants or bites from poisonous, disease-carrying, or otherwise dangerous animals or insects (snakes, ticks, etc.) are often prevalent at sites that are being investigated as part of hazardous waste site operations. During warm months (spring through early fall), tick-borne Lyme Disease may pose a potential health hazard. The longer a disease-carrying tick remains attached to the body, the greater the potential for contracting the disease. Wearing long -sleeved shirts and long pants (tucked into boots and taped) will prevent initial tick attachment, while performing frequent body checks will help prevent long term attachment. Site first aid kits should be equipped with medical forceps and rubbing alcohol to assist in tick removal. For information regarding tick removal procedures and symptoms of exposure, consult Section 4.0 of the Health and Safety Guidance Manual and Attachment II of this HASP.

Contact with poisonous plants and bites or stings from poisonous insects are other potential natural hazards. Long sleeved shirts and long pants (tucked into boots), and avoiding potential nesting areas, will minimize the potential for exposure. Additionally, site personnel may use insect repellents. Personnel who are allergic to stinging insects (such as bees, wasps and hornets) must be particularly careful since severe illness and death may result from allergic reactions. As with any medical condition or allergy, information regarding the condition must be listed on the Medical Data Sheet (see Section 7 of the Health and Safety Guidance Manual), and the FOL or SSO notified.

Fire ants present a unique situation when working outdoors in Florida. Their aggressive behavior and their ability to sting repeatedly can pose a unique health threat. The sting injects a venom that causes an extreme burning sensation. Pustules from which can become infected if scratched. Allergic reactions of people sensitive to the venom include dizziness, swelling, shock and in extreme cases unconsciousness and death. People exhibiting such symptoms should see a physician.

7.0 AIR MONITORING

Direct reading instruments will be used at the site to detect and evaluate the presence of site contaminants and other potentially hazardous conditions. As a result, specific air monitoring measures and requirements are established in Table 5-1 pertaining to the specific hazards and tasks of an identified operation. Additionally, the Health and Safety Guidance Manual, Section 1.0, contains detailed information regarding direct reading instrumentation, as well as general calibration procedures of various instruments.

7.1 INSTRUMENTS AND USE

Instruments will be used primarily to monitor source points and worker breathing zone areas, while observing instrument action levels. Action levels are discussed in Table 5-1 as they may apply to a specific task or location.

7.1.1 Photoionization Detector (PID) and Flame Ionization Detector (FID)

In order to accurately monitor for many of the substances which may present an inhalation hazard to site personnel, a PID using a lamp energy of 10.6 eV (or higher) or an FID will be used. These instruments will be used to monitor potential source areas and to screen the breathing zones of employees during site activities. The PID and FID have been selected because they are capable of detecting the organic vapors of concern.

Prior to the commencement of any field activities, the background levels of the site must be determined and noted. Daily background readings will be taken away from any areas of potential contamination. These readings, any influencing conditions (i.e., weather, temperature, humidity) and site location must be documented in the field operations logbook or other site documentation (e.g., sample log sheet).

7.1.2 Hazard Monitoring Frequency

Table 5-1 presents the frequencies that hazard monitoring will be performed as well as the action levels which will initiate the use of elevated levels of protection. The SSO may decide to increases these frequencies based on instrument responses and site observations. The frequency at which monitoring is performed will not be reduced without the prior consent of the PHSO or HSM.

7.2 INSTRUMENT MAINTENANCE AND CALIBRATION

Hazard monitoring instruments will be maintained and pre-field calibrated by the TtNUS Equipment Manager. Operational checks and field calibration will be performed on all instruments each day prior to their use. Field calibration will be performed on instruments according to manufacturer's recommendations (for example, the PID must be field calibrated daily and an additional field calibration must be performed at the end of each day to determine any significant instrument drift). These operational checks and calibration efforts will be performed in a manner that complies with the employees health and safety training, the manufacturer's recommendations, and with the applicable manufacturer standard operating procedure (copies of which can be found in the Health & Safety Guidance Manual which will be maintained on site for reference). All calibration efforts must be documented. Figure 7-1 is provided for documenting these calibration efforts. This information may instead be recorded in a field operations logbook, provided that all of the information specified in Figure 7-1 is recorded. This required information includes the following:

- Date calibration was performed
- Individual calibrating the instrument
- Instrument name, model, and serial number
- Any relevant instrument settings and resultant readings (before and after) calibration
- Identification of the calibration standard (lot no., source concentration, supplier)
- Any relevant comments or remarks

FIGURE 7-1

DOCUMENTATION OF FIELD CALIBRATION

SITE NAME: ______________________ PROJECT NO.:__________

Date of Calibration	Instrument Name and Model	Instrument I.D. Number	Person Performing Calibration	Instrument Settings		Instrument Readings		Calibration Standard (Lot Number)	Remarks/ Comments
				Pre-Calibration	Post-Calibration	Pre-Calibration	Post-Calibration		

8.0 TRAINING/MEDICAL SURVEILLANCE REQUIREMENTS

8.1 INTRODUCTORY/REFRESHER/SUPERVISORY TRAINING

This section is included to specify health and safety training and medical surveillance requirements for both TtNUS and subcontractor personnel participating in site activities.

8.1.1 <u>Requirements for TtNUS Personnel</u>

All TtNUS personnel must complete 40 hours of introductory hazardous waste site training prior to performing work at NAS Whiting Field. Additionally, TtNUS personnel who have had introductory training more than 12 months prior to site work must have completed 8 hours of refresher training within the past 12 months before being cleared for site work. In addition, 8-hour supervisory training in accordance with 29 CFR 1910.120(e)(4) will be required for site supervisory personnel.

Documentation of TtNUS introductory, supervisory, and refresher training as well as site-specific training will be maintained at the project. Copies of certificates or other official documentation will be used to fulfill this requirement.

TtNUS will conduct a pre-activities training session prior to initiating site work. Additionally, a brief meeting will be held daily to discuss operations planned for that day. At the end of the workday, a short meeting will be held to discuss the operations completed and any problems encountered. This activity will be supported through the use of a Safe Work Permit System (See Section 10.10).

8.1.2 <u>Requirements for Subcontractors</u>

All TtNUS subcontractor personnel must have completed introductory hazardous waste site training or equivalent work experience as defined in OSHA Standard 29 CFR 1910.120(e) and 8 hours of refresher training meeting the requirements of 29 CFR 1910.120(e)(8) prior to performing field work at NAS Whiting Field. TtNUS subcontractors must certify that each employee has had such training by sending TtNUS a letter, on company letterhead, containing the information in the example letter provided in Figure 8-1 and by providing copies of certificates for all subcontractor personnel participating in site activities.

FIGURE 8-1

TRAINING LETTER

The following statements must be typed on company letterhead, signed by an officer of the company and accompanied by copies of personnel training certificates:

LOGO
XYZ CORPORATION
555 E. 5th Street
Nowheresville, Kansas 55555

Month, day, year

Mr. Terry Hansen
Task Order Manager
Tetra Tech NUS, Inc.
1311 Executive Center Drive, Suite 220
Tallahassee, Florida 32301

Subject: HAZWOPER Training for NAS Whiting Field, Milton, Florida

Dear Mr. Hansen:

As an officer of XYZ Corporation, I hereby state that I am aware of the potential hazardous nature of the subject project. I also understand that it is our responsibility to comply with all applicable occupational safety and health regulations, including those stipulated in Title 29 of the Code of Federal Regulations (CFR), Parts 1900 through 1910 and Part 1926.

I also understand that Title 29 CFR 1910.120, entitled "Hazardous Waste Operations and Emergency Response," requires an appropriate level of training for certain employees engaged in hazardous waste operations. In this regard, I hereby state that the following employees have had 40 hours of introductory hazardous waste site training or equivalent work experience as requested by 29 CFR 1910.120(e) and have had 8 hours of refresher training as applicable and as required by 29 CFR 1910.120(e)(8) and that site supervisory personnel have had training in accordance with 29 CFR 1910.120(e)(4).

LIST FULL NAMES OF EMPLOYEES AND THEIR SOCIAL SECURITY NUMBERS HERE.

Should you have any questions, please contact me at (555) 555-5555.

Sincerely,

(Name and Title of Company Officer)

8.2 SITE-SPECIFIC TRAINING

TtNUS will provide site-specific training to all site personnel who will perform work on this project. Site-specific training will also be provided to all personnel [U.S. Department of Defense (DOD), EPA, etc.] who may enter the site to perform functions that may or may not be directly related to site operations. Site-specific training will include:

- Names of designated personnel and alternates responsible for site safety and health
- Safety, health, and other hazards present on site
- Use of personal protective equipment
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment
- Medical surveillance requirements
- Signs and symptoms of overexposure
- Contents of the Health and Safety Plan
- Emergency response procedures (evacuation and assembly points)
- Spill response procedures
- Review of the contents of relevant Material Safety Data Sheets

Site-specific documentation will be established through the use of Figure 8-2. All site personnel and visitors must sign this document upon receiving site-specific training.

8.3 MEDICAL SURVEILLANCE

8.3.1 Medical Surveillance Requirements for TtNUS Personnel

All TtNUS personnel participating in project field activities will have had a physical examination meeting the requirements of TtNUS's medical surveillance program and will be medically qualified to perform hazardous waste site work using respiratory protection

Documentation for medical clearances will be maintained in the TtNUS Pittsburgh office and made available, as necessary.

FIGURE 8-2

SITE-SPECIFIC TRAINING DOCUMENTATION

My signature below indicates that I am aware of the potential hazardous nature of performing remedial investigation activities at NAS Whiting Field, Milton, Florida, and that I have received site-specific training which included the elements presented below:

- Names of designated personnel and alternates responsible for site safety and health
- Safety, health, and other hazards present on site
- Use of personal protective equipment
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment
- Medical surveillance requirements
- Signs and symptoms of overexposure
- Contents of the Health and Safety Plan
- Emergency response procedures (evacuation and assembly points)
- Spill response procedures
- Review of contents of relevant Material Safety Data Sheets

I further state that I have been given the opportunity to ask questions, that all of my questions have been answered to my satisfaction, and that I agree to abide by the procedures and policies addresses in this plan.

I further state, by the presence of my signature below, that the date of my training (introductory, refresher, and supervisory, as applicable) and my medical surveillance requirements are accurate and correct to the best of my knowledge.

Name	40-Hour General Site Worker Training (Date)	8-Hour Refresher Training (Date)	8-Hour Supervisory Training (Date)	Date of Medical Surveillance	SIGNATURE

8.3.2 Medical Surveillance Requirements for Subcontractors

Subcontractors are required to obtain a certificate of their ability to perform hazardous waste site work and to wear respiratory protection. The "Subcontractor Medical Approval Form" provided in Figure 8-3 shall be used to satisfy this requirement, providing it is properly completed and signed by a licensed physician.

Subcontractors who have a company medical surveillance program meeting the requirements of paragraph (f) of OSHA 29 CFR 1910.120 can substitute "Subcontractor Medical Approval Form" with a letter, on company letterhead, containing all of the information in the example letter presented in Figure 8-4 of this HASP.

8.3.3 Requirements for All Field Personnel

Each field team member (including subcontractors) and visitors entering the exclusion zone(s) shall be required to complete and submit a copy of Medical Data Sheet presented in Tab 7 of the Health and Safety Guidance Manual. This shall be provided to the SSO, prior to participating in site activities. The purpose of this document is to provide site personnel and emergency responders with additional information that may be necessary in order to administer medical attention.

8.4 SUBCONTRACTOR EXCEPTIONS

Subcontractors who will not enter the exclusion zone during operation, and whose activities involve no potential for exposure to site contaminants, will not be required to meet the requirements for training/medical surveillance other than site-specific training as stipulated in Section 8.2.

FIGURE 8-3
SUBCONTRACTOR MEDICAL APPROVAL FORM

For employees of ____
Company Name

Participant Name: ____________________________ Date of Exam: ____________________

Part A

The above-named individual has:

1. Undergone a physical examination in accordance with OSHA Standard 29 CFR 1910.120, paragraph (f), and was found to be medically -

   ( ) qualified to perform work at the NAS Whiting Field work site
   ( ) not qualified to perform work at the NAS Whiting Field work site

and,

2. Undergone a physical examination in accordance with OSHA 29 CFR 1910.134(b)(10) and was found to be medically -

   ( ) qualified to wear respiratory protection
   ( ) not qualified to wear respiratory protection

My evaluation has been based on the following information, as provided to me by the employer.

( ) A copy of OSHA Standard 29 CFR 1910.120 and appendices.
( ) A description of the employee's duties as they relate to the employee's exposures.
( ) A list of known/suspected contaminants and their concentrations (if known).
( ) A description of any personal protective equipment used or to be used.
( ) Information from previous medical examinations of the employee that is not readily available to the examining physician.

Part B

I, ______________________________, have examined ______________________________
Physician's Name (print) Participant's Name (print)

and have determined the following information:

FIGURE 8-3
SUBCONTRACTOR MEDICAL APPROVAL FORM
PAGE TWO

1. Results of the medical examination and tests (excluding finding or diagnoses unrelated to occupational exposure):

    ____
    ____
    ____

2. Any detected medical conditions which would place the employee at increased risk of material impairment of the employee's health:

    ____
    ____
    ____

3. Recommended limitations upon the employee's assigned work:

    ____
    ____
    ____

I have informed this participant of the results of this medical examination and any medical conditions which require further examination of treatment.

Based on the information provided to me, and in view of the activities and hazard potentials involved at the NAS Whiting Field work site, this participant

( ) may
( ) may not

perform his/her assigned task.

Physician's Signature ________________________

Address ________________________

Phone Number ________________________

NOTE: Copies of test results are maintained and available at:

____
Address

FIGURE 8-4

MEDICAL SURVEILLANCE LETTER

The following statements must be typed on company letterhead and signed by an officer of the company:

LOGO
XYZ CORPORATION
555 E. 5th Street
Nowheresville, Kansas 55555

Month, day, year

Mr. Terry Hansen
Task Order Manager
Tetra Tech NUS, Inc.
1311 Executive Center Drive, Suite 220
Tallahassee, Florida 32301

Subject: Medical Surveillance for NAS Whiting Field, Milton, Florida

Dear Mr. Hansen:

As an officer of XYZ Corporation, I hereby state that the persons listed below participate in a medical surveillance program meeting the requirements contained in paragraph (f) of Title 29 of the Code of Federal Regulations (CFR), Part 1910.120, entitled "Hazardous Waste Operations and Emergency Response: Final Rule." I further state that the persons listed below have had physical examinations under this program within the past 12 months and that they have been cleared, by a licensed physician, to perform hazardous waste site work and to wear positive- and negative-pressure respiratory protection. I also state that, to my knowledge, no person listed below has any medical restriction that would preclude him/her from working at the NAS Whiting Field, Milton, Florida site.

LIST FULL NAMES OF EMPLOYEES AND THEIR SOCIAL SECURITY NUMBERS HERE.

Should you have any questions, please contact me at (555) 555-5555.

Sincerely,

(Name and Title of Company Officer)

9.0 SPILL CONTAINMENT PROGRAM

9.1 SCOPE AND APPLICATION

It is anticipated that quantities of bulk potentially hazardous materials (e.g., 55-gallons) may be handled during some of the site activities conducted as part of the scope of work. Significant quantities of waste water (decontamination, purge and development) and Investigative-Derived Wastes (IDW) may be generated as part of site activities. It is not anticipated, however, that spillage of these materials would constitute a significant danger to human health or the environment. Further, it is possible that as the job progresses disposable PPE and other non-reusable items may be generated. As needed, 55 -gallon drums will be used to contain waste waters, IDW, and other unwanted items generated during investigatory activities. These drums will be labeled with the site name and address, the type of contents, and the date the container was filled as well as an identified contact person. Samples will be collected and analyzed to characterize the material and determine appropriate disposal measures. Once characterized they can be removed from the staging area and disposed of in accordance with Federal, State and local regulations. Table 5-1 contains detailed information about handling IDW at NAS Whiting Field.

9.2 POTENTIAL SPILL AREAS

Potential spill areas will be monitored in an ongoing attempt to prevent and control further potential contamination of the environment. Currently, there are various areas vulnerable to this hazard including the areas used for central staging and decontamination activities. Additionally, areas designated for handling, loading, and unloading of potentially contaminated soils, waters, and debris present limited potential for leaks or spills. It is anticipated that all IDW generated as a result of this scope of work will be containerized, labeled, and staged to await chemical analyses. The results of these analyses will determine appropriate disposal methods.

9.2.1 Site Drums/Containers

All drums/containers used for containing soils and liquids will be sealed, labeled, and staged within a centralized area awaiting shipment or disposal.

9.3 LEAK AND SPILL DETECTION

To establish an early detection of potential spills or leaks, periodic inspections by the SSO will be conducted during working hours to visually determine that containers are not leaking. If a leak is detected, the first approach will be to transfer the container contents using a hand pump into a new container. Other provisions for the transfer of container contents will be made and appropriate emergency contacts will be notified, if necessary. In most instances, leaks will be collected and contained using absorbents such as Oil-dry, vermiculite, or sand, which will be stored at the staging area in a conspicuously marked drum. This material too, will be containerized for disposal pending analyses. All inspections will be documented in the Project Logbook.

9.4 PERSONNEL TRAINING AND SPILL PREVENTION

All personnel will be instructed on the procedures for spill prevention, containment, and collection of hazardous materials in the site-specific training. The FOL and/or the SSO will serve as the Spill Response Coordinator for this operation should the need arise.

9.5 SPILL PREVENTION AND CONTAINMENT EQUIPMENT

The following represents the types of equipment that may be maintained at the site for the purpose of supporting this Spill Prevention/Containment Program.

- Sand, clean fill, vermiculite, or other noncombustible absorbent (oil-dry);
- Drums (55-gallon U.S. DOT 17-E or 17-H)
- Shovels, rakes, and brooms
- Hand operated drum pump with hose
- Labels

9.6 SPILL CONTROL PLAN

This section describes the procedures the TtNUS field crew members will employ upon the detection of a spill or leak.

1) Notify the SSO or FOL immediately.

2) Employ the personnel protective equipment stored at the staging area. Take immediate actions to stop the leak or spill by plugging or patching the drum or raising the leak to the highest point. Spread the absorbent material in the area of the spill covering completely.

3) Transfer the material to a new container, collect and containerize the absorbent material. Label the new container appropriately. Await analyses for treatment or disposal options.

4) All spills will be recontainerized with 2-inches of top cover, and await test results for treatment or disposal options.

It is not anticipated that a spill will occur in which the field crews cannot handle. Should this occur; however, notification of appropriate emergency response agencies will be carried out by the FOL or SSO.

10.0 SITE CONTROL

This section outlines the means by which TtNUS will delineate work zones and use these work zones in conjunction with decontamination procedures to prevent the spread of contaminants into previously unaffected areas of the site. It is anticipated that a three-zone approach will be used during work at this site. This three zone approach will utilize an exclusion zone, a contamination reduction zone, and a support zone. It is also anticipated that this control measure will be used to control access to site work areas. Use of such controls will restrict the general public, minimize the potential for the spread of contaminants, and protect individuals who are not cleared to enter work areas.

10.1 EXCLUSION ZONE

The exclusion zone will be considered those areas of the site of known or suspected contamination. It is not anticipated that significant amounts of surface contamination are present in the proposed work areas of this site. It is anticipated that this will remain so until/unless contaminants are brought to the surface by intrusive activities, such as soil boring or sampling operations. Furthermore, once intrusive activities have been completed and surface contamination has been removed, the potential for exposure is again diminished and the area can then be reclassified as part of the contamination reduction zone. Therefore, the exclusion zones for this project will be limited to those areas of the site where active work is being performed plus a designated area surrounding the point of operation (see Table 5-1 for specific operation). When possible, exclusion zones will be delineated using barrier tape, cones and/or drive poles, and postings to inform site personnel.

10.1.1 Exclusion Zone Clearance

Prior to the initiation of site activities, utility locations will be identified by utility companies contacted through Jim Holland (the NAS Whiting Field Contact) at (850) 623-7181, extension 149. Additional utility surveys may be conducted by TtNUS through the use of available documentation provided by NAS Whiting Field and/or local utility companies. The positions of identified utilities will be field located and staked to minimize the potential for damage during intrusive activities. Sample locations can be located to avoid buried utilities. In the event that a utility is struck during a subsurface investigative activity, the emergency numbers provided in Table 2-1 will be notified.

Access to work areas will be controlled by TtNUS personnel. No personnel will be permitted to enter site exclusion zones without site-specific training. Site visitors will be provided site-specific training and will be escorted by TtNUS personnel at all times (see section 10.4).

10.2 CONTAMINATION REDUCTION ZONE

The contamination reduction zone (CRZ) will be a buffer area between the exclusion zone and any area of the site where contamination is not suspected. The personnel and equipment decontamination will not take place in this area, but will take place at a central location established for this project. This area instead will serve as a focal point in supporting exclusion zone activities. When applicable, this area will be delineated using barrier tape, cones and/or drive poles, and postings to inform and direct facility personnel.

10.3 SUPPORT ZONE

The support zone for this project will include a staging area where site vehicles will be parked, equipment will be unloaded, and where food and drink containers will be maintained. In all cases, the support zones will be established at areas of the site where exposure to site contaminants would not be expected during normal working conditions or foreseeable emergencies.

10.4 SITE VISITORS

Site visitors for the purpose of this document are identified as representing the following groups of individuals:

- Personnel invited to observe or participate in operations by TtNUS
- Regulatory personnel (EPA, OSHA, etc.)
- NAS Whiting Field
- Other authorized visitors

All personnel working on this project are required to gain initial access to the site by coordinating with the TtNUS FOL or designee and following established site access procedures.

Upon gaining access to the site, all site visitors wishing to observe operations in progress will be escorted by a TtNUS representative (arranged for by the FOL) and shall be required to meet the minimum requirements discussed below:

- All site visitors will be routed to the FOL, who will sign them into the field logbook. Information to be recorded in the logbook will include the individual's name (proper identification required), the entity which they represent, and the purpose of the visit.

- All site visitors will be required to produce the necessary information supporting clearance to the site. This shall include information attesting to applicable training (40-hours of HAZWOPER training) and medical surveillance as stipulated in Section 8.0 of this document. In addition, to enter the site operational zones during planned activities, all visitors will be required to first go through site-specific training covering the topics stipulated in Section 8.2 of this HASP.

Once the site visitors have completed the above items, they will be permitted to enter the operational zone. All visitors are required to observe the protective equipment and site restrictions in effect at the site at the time of their visit. Any and all visitors not meeting the requirements stipulated in this plan will not be permitted to enter the site operational zones during planned activities. Any incidence of unauthorized site visitation will cause the termination of all onsite activities until the unauthorized visitor is removed from the premises. Removal of unauthorized visitors will be accomplished with support from the FOL, SSO or on-site security personnel.

10.5 SITE SECURITY

Site security will be accomplished using existing base security resources and procedures, supplemented by TtNUS or subcontractor personnel, if necessary. TtNUS will retain control over active operational areas. The first line of security will take place at the base boundaries restricting the general public. The second line of security will take place at the work site referring interested parties to the FOL. The FOL will serve as a focal point for site personnel, and will serve and the final line of security and the primary enforcement contact.

10.6 SITE MAPS

Once the areas of contamination, access routes, utilities, topography, and dispersion routes are determined, a site map will be generated and adjusted as site conditions change. These maps will show utility locations, potential points of contact with the public, roadways, and other significant characteristics that may impact site operations and safety. Site maps will be posted to illustrate up-to-date collection of contaminants and adjustment of zones and access points.

10.7 BUDDY SYSTEM

Personnel engaged in onsite activities will practice the "buddy system" to ensure the safety during this operation.

10.8 MATERIAL SAFETY DATA SHEET (MSDS) REQUIREMENTS

TtNUS and subcontractor personnel will provide MSDSs for all chemicals brought on site. The contents of these documents will be reviewed by the SSO with the user(s) of the chemical substances prior to any actual use or application of the substances on site. A chemical inventory of all chemicals used on site will be developed using Section 5.0 of the Health and Safety Guidance Manual. The MSDSs will then be maintained in a central location and will be available for anyone to review upon request.

10.9 COMMUNICATION

TtNUS personnel will be working in close proximity to each other at NAS Whiting Field. As a result and since two way radio communication will not be available, hand signals, voice commands, and line of site will provide sufficient means of communication. When project tasks are performed simultaneously on different sites, vehicle horns will be used to communicate emergency situations per Section 2.6 of this HASP.

External communication will be accomplished by using provided telephones at the site. External communication will primarily be used for the purpose of resource and emergency resource communications.

10.10 SAFE WORK PERMITS

All exclusion zone work conducted in support of this project will be performed using Safe Work Permits to guide and direct field crews on a task by task basis. An example of the Safe Work Permit to be used is illustrated in Figure 10-1. Partially completed Safe Work Permits for each intrusive task are included in Appendix IV of this HASP. These work permits will be further supported by the daily meetings conducted during their generation. This effort will ensure all site-specific considerations and changing conditions are incorporated into the planning effort.

Use of these permits will provide the communication line for reviewing protective measures and hazards associated with each operation. This HASP will be used as the primary reference for selecting levels of protection and control measures. The work permit will take precedence over the HASP when more conservative measures are required based on specific site conditions.

The FOL and/or the SSO will be responsible for completing the safe work permit and issuing them to the appropriate parties. Site personnel at the end of each days activity will turn in the permit(s) used for that day to the SSO. All permits will be maintained as part of the permanent project files attesting to safety and health measures employed for a given task at a given time and place. Any problems encountered with the protective measures required should be documented on the permit and brought to the attention of the SSO.

FIGURE 10-1
SAFE WORK PERMIT

Permit No. ____________ Date: ______________ Time: From __________ to ____________

SECTION I: General Job Scope (To be filled in by person performing work)

I. Work limited to the following (description, area, equipment used): ____________

II. Names: ____________

III. Onsite Inspection conducted ☐ Yes ☐ No Initials of Inspector ________ ________
TtNUS

SECTION II: General Safety Requirements (To be filled in by permit issuer)

IV. Protective equipment required

Level D ☐ Level B ☐
Level C ☐ Level A ☐
Detailed on Reverse

Respiratory equipment required

Full face APR	☐	Escape Pack	☐
Half face APR	☐	SCBA	☐
SKA-PAC SAR	☐	Bottle Trailer	☐
Skid Rig	☐	None	☐

Modifications/Exceptions: ____________

V. Chemicals of Concern	Action Level(s)	Response Measures

VI. Additional Safety Equipment/Procedures

Hardhat	☐ Yes	☐ No
Safety Glasses	☐ Yes	☐ No
Chemical/splash goggles	☐ Yes	☐ No
Splash Shield	☐ Yes	☐ No
Splash suits/coveralls	☐ Yes	☐ No
Steel toe/shank	☐ Yes	☐ No
Workboots	☐ Yes	☐ No
Hearing Protection	☐ Yes	☐ No
Safety belt/harness	☐ Yes	☐ No
Radio	☐ Yes	☐ No
Barricades	☐ Yes	☐ No
Gloves (Type)	☐ Yes	☐ No
Work/rest regimen	☐ Yes	☐ No

Modifications/Exceptions: ____________

VII. Procedure review with permit acceptors

	Yes	NA
Safety shower/eyewash (Location & Use)	☐	☐
Procedure for safe job completion	☐	☐
Contractor tools/equipment inspected	☐	☐
Emergency alarms	☐	☐
Evacuation routes	☐	☐
Assembly points	☐	☐

VIII. Equipment Preparation

	Yes	NA
Equipment drained/depressured	☐	☐
Equipment purged/cleaned	☐	☐
Isolation checklist completed	☐	☐
Electrical lockout required/field switch tested	☐	☐
Blinds/misalignments/blocks & bleeds in place	☐	☐
Hazardous materials on walls/behind liners considered	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.)......... ☐ Yes ☐ No
If yes, contact Health Science, Pittsburgh, PA Office

X. Special instructions, precautions: ____________

Permit Issued by: ____________ Permit Accepted by: ____________
Job Completed by: ____________ Date: ____________

11.0 CONFINED SPACE ENTRY

It is not anticipated, under the proposed scope of work, that confined space and permit-required confined space activities will be conducted. **Therefore, personnel under the provisions of this HASP are not allowed, under any circumstances, to enter confined spaces.** A confined space is defined as an area which has one or more of the following characteristics:

- Is large enough and so configured that an employee can bodily enter and perform assigned work.
- Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry).
- Is not designed for continuous employee occupancy.

A Permit-Required Confined Space is one that:

- Contains or has a potential to contain a hazardous atmosphere.
- Contains a material that has the potential to engulf an entrant.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.
- Contains any other recognized, serious, safety or health hazard.

For further information on confined space, consult the Health and Safety Guidance Manual or call the PHSO. If confined space operations are to be performed as part of the scope of work, detailed procedures and training requirements will have to be addressed.

12.0 MATERIALS AND DOCUMENTATION

The TtNUS FOL shall ensure the following materials/documents are taken to the project site and used when required.

- A complete copy of this HASP
- Health and Safety Guidance Manual
- Incident Reports
- Medical Data Sheets
- Material Safety Data Sheets for all chemicals brought on site, including decon solutions, fuels, lime, sample preservatives, calibration gases, etc.
- A full-size OSHA Job Safety and Health Poster (posted in the site trailers)
- Training/Medical Surveillance Documentation Form (Blank)
- Emergency Reference Information (Section 2.0, extra copy for posting)

12.1 MATERIALS TO BE POSTED AT THE SITE

The following documentation is to be posted at the site for quick reference purposes. In situations where posting of these documents is not feasible (such as no office trailer), these documents should be filed in a transportable file container and immediately accessible. The file should remain in the FOL's possession.

Chemical Inventory Listing - This list represents all chemicals brought on site, including decontamination solutions, sample preservatives, fuel, calibration gases, etc.. This list should be posted in a central area.

Material Safety Data Sheets (MSDSs) - The MSDSs should also be in a central area accessible to all site personnel. These documents should match all the listings on the chemical inventory list for all substances employed on site. It is acceptable to have these documents within a central folder and the chemical inventory as the table of contents.

The OSHA Job Safety & Health Protection Poster - This poster, as directed by 29 CFR 1903.2 (a)(1), should be conspicuously posted in places where notices to employees are normally posted. Each FOL shall ensure that this poster is not defaced, altered, or covered by other material.

Site Clearance Posting - This list is found within the training section of the HASP (See Figure 8-1). This list identifies all site personnel, dates of training (including site-specific training), and medical surveillance and indicates not only clearance but also status. If personnel do not meet these requirements, they do not enter the site while site personnel are engaged in activities.

Emergency Phone Numbers and Directions to the Hospital(s) - This list of emergency numbers and hospital directions will be maintained at all phone communications points and in each site vehicle.

Medical Data Sheets/Cards - Medical Data Sheets will be filled out by all onsite personnel and filed in a central location. The Medical Data Sheet will accompany any injury or illness requiring medical attention to the medical facility. A copy of this sheet or a wallet card will be given to all personnel to be carried on their person.

Personnel Monitoring - All results generated through personnel sampling (levels of airborne toxics, noise levels, etc.) will be posted to inform individuals of the results of that effort.

Placards and Labels - Where chemical inventories have been separated, because of quantities and incompatibilities, these areas will be conspicuously marked using Department of Transportation (DOT) placards and acceptable [Hazard Communication 29 CFR 1910.1200 (f)] labels.

13.0 GLOSSARY

ACGIH	American Conference of Governmental Industrial Hygienists
APR	Air Purifying Respirators
CFR	Code of Federal Regulations
CNS	Central Nervous System
CRZ	Contamination Reduction Zone
DOD	Department of Defense
DOT	Department of Transportation
EPA	Environmental Protection Agency
eV	electron Volts
FID	Flame Ionization Detector
FOL	Field Operations Leader
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	High Efficiency Particulate Air
N/A	Not Available
NIOSH	National Institute Occupational Safety and Health
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor)
PEL	Permissible Exposure Limit
PHSO	Project Health and Safety Officer
PID	Photo Ionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
SAP	Sampling and Analysis Plan
SSO	Site Safety Officer
STEL	Short Term Exposure Limit
TOM	Task Order Manager
TPH	Total Petroleum Hydrocarbons
TWA	Time Weighted Average
VOCs	Volatile Organic Compounds
UV	Ultraviolet
WP	Work Plan

ATTACHMENT I

INJURY/ILLNESS PROCEDURE AND REPORT FORM

CASE NO. ________

TETRA TECH NUS, INC.

INJURY/ILLNESS PROCEDURE
WORKER'S COMPENSATION PROGRAM

WHAT YOU SHOULD DO IF YOU ARE INJURED OR DEVELOP AN ILLNESS AS A RESULT OF YOUR EMPLOYMENT:

- If injury is minor, obtain appropriate first aid treatment.
- If injury or illness is severe or life threatening, obtain professional medical treatment at the nearest hospital emergency room.
- If incident involves a chemical exposure on a project work site, follow instructions in the Health & Safety Plan.
- Immediately report any injury or illness to your supervisor or office manager. In addition, you must contact your Human Resources representative, Marilyn Diethorn at (412) 921-8475, and the Corporate Health and Safety Manager, Matt Soltis at (412) 921-8912 within 24 hours. You will be required to complete an Injury/Illness Report (attached). You may also be required to participate in a more detailed investigation from the Health Sciences Department.
- If further medical treatment is needed, The Hartford Network Referral Unit will furnish a list of network providers customized to the location of the injured employee. These providers are to be used for treatment of Worker's Compensation injuries subject to the laws of the state in which you work. Please call Marilyn Diethorn at (412) 921-8475 for the number of the Referral Unit.

ADDITIONAL QUESTIONS REGARDING WORKER'S COMPENSATION:

Contact your local human resources representative, corporate health and safety coordinator, or Corporate Administration in Pasadena, California, at (626) 351-4664.

Worker's compensation is a state-mandated program that provides medical and disability benefits to employees who become disabled due to job related injury or illness. Tetra Tech, Inc. and its subsidiaries (Tetra Tech or Company) pay premiums on behalf of their employees. The type of injuries or illnesses covered and the amount of benefits paid are regulated by the state worker's compensation boards and vary from state to state. Corporate Administration in Pasadena is responsible for administering the Company's worker's compensation program. The following is a general explanation of worker's compensation provided in the event that you become injured or develop an illness as a result of your employment with Tetra Tech or any of its subsidiaries. Please be aware that the term used for worker's compensation varies from state to state.

WHO IS COVERED:

All employees of Tetra Tech, whether they are on a full-time, part-time or temporary status, working in an office or in the field, are entitled to worker's compensation benefits. All employees must follow the above injury/illness reporting procedures. Consultants, independent contractors, and employees of subcontractors are <u>not</u> covered by Tetra Tech's Worker's Compensation plan.

WHAT IS COVERED:

If you are injured or develop an illness caused by your employment, worker's compensation benefits are available to you subject to the laws of the state you work in. Injuries do not have to be serious; even injuries treated by first aid practices are covered and must be reported. Please note that if you are working out-of-state and away from your home office, you are still eligible for worker's compensation benefits.

CASE NO. ________

TETRA TECH NUS, INC.
INJURY/ILLNESS PROCEDURE
WORKER'S COMPENSATION PROGRAM

To: Corporate Health and Safety Manager
Human Resource Administrator

Project Name: ____________________

Project No. ____________________

Prepared by: ____________________

Position: ____________________

Office: ____________________

Telephone: ____________________

Information Regarding Injured or Ill Employee:

Name: ____________________

Home address: ____________________

____

Home telephone: ____________________

Occupation (regular job title): ____________________

Department: ____________________

Office: ____________________

Gender: M ☐ F ☐ No. of dependents: ______

Marital status: ____________________

Date of birth: ____________________

Social Security No.: ____________________

Date of Accident: ____________________ **Time of Accident:** ____________________

Location of Accident Was place of accident or exposure on employer's premises Yes ☐ No ☐

Street address: ____________________

City, state, and zip code: ____________________

County: ____________________

Narrative Description of How Accident Occurred: (Be specific. Explain what the employee was doing and how the accident occurred.)

TETRA TECH, INC.
INJURY/ILLNESS REPORT

Did employee die? Yes ☐ No ☐
Was employee performing regular job duties? Yes ☐ No ☐
Was safety equipment provided? Yes ☐ No ☐
Was safety equipment used? Yes ☐ No ☐
Note: Attach any police reports or related diagrams to this accident report.

Witness(es):
Name:
Address:
Telephone:

Describe the Illness or Injury and Part of Body Affected:

Name the Object or Substance which Directly Injured the Employee:

Medical Treatment Required:	**Lost Work Days:**
☐ No ☐ Yes ☐ First Aid Only	☐ No. of Lost Work Days ______
Physician's Name: ______	Last Date Worked ______
Address: ______	Time Employee Left Work ______
Hospital or Office Name: ______	Date Employee Returned to Work ______
Address: ______	☐ No. of Restricted Work Days ______
______	☐ None
Telephone No.: ______	

Corrective Action(s) Taken by Unit Reporting the Accident:

Corrective Action Still to be Taken (by whom and when):

Name of Tetra Tech employee the injury or illness was first reported to: ______________________

Date of Report: ______________________ Time of Report: ______________________

	Printed Name	Signature	Telephone No.	Date
Project or Office Manager				
Site Safety Coordinator				
Injured Employee				

To be completed by Human Resources:

Date of hire: Hire date in current job:

Wage information: $ ____________ per ________ (hour, day, week, or month)

Position at time of hire:

Shift hours:

State in which employee was hired:

Status: ☐ Full-time ☐ Part-time Hours per week: ________ Days per week: ________

Temporary job end date:

To be completed during report to workers' compensation insurance carrier:

Date reported: Reported by:

TeleClaim phone number:

TeleClaim account number:

Location code:

Confirmation number:

Name of contact:

Field office of claims adjuster:

ATTACHMENT II

TICK CONTROL
AND
LYME DISEASE

TICK CONTROL
AND
LYME DISEASE

The occurrence of Lyme disease has become a worldwide problem since its identification in 1976. This disease is characteristically recognized as being transmitted by ticks, which may be encountered by field personnel while working at this site. As a result, this discussion has been included with this Health and Safety Plan to provide for adequate recognition, evaluation, and control efforts to minimize the occurrence and effects of this potential hazard.

The discovery of Lyme disease is credited to Dr. Allen Steere of Yale University Medical School, and is named after the community where it was (reportedly) first encountered, Lyme, Connecticut. This disease can be transmitted to man through the bite of ticks that are infected with a cork screw-shaped microbe (spirochete). The spread of this disease has been so rapid that in 1984 it surpassed Rocky Mountain Spotted fever as the most common tick-borne disease in the United States. In this country, most of the incidents of this disease have been recorded in the Northeast, and the tick species most commonly attributed with its spread is the deer tick.

Recognition

This hazard potential exists primarily in the spring and summer months, as these are the seasons that tick populations and activity flourish. In fact, 90 percent of the reported cases have occurred from early June through September. Also, this concern exists primarily in heavily vegetated areas. Therefore, recognition of these factors can aid in the awareness and control of this threat.

To aid in the recognition and identification of these insects, an example illustration of the tick species common to the region where this site is located has been included with this discussion. This species (the American Dog tick) is common in the eastern half of the United States, and typically exists in areas covered with grass or underbrush. These insects will attach themselves to animals (including man) that pass through the area and rub against them. After finding a host, the tick inserts its mouthparts and sucks blood until it is fully engorged. This requires a time period of three to twelve days, then the tick will drop off. In addition to Lyme disease concerns, this tick has also been identified as a transmitter of Rocky Mountain Spotted Fever, and the organisms of tularemia and possibly relapsing fever. The wounds left by tick bites can be painful, and can also have a paralyzing effect commonly referred to as tick paralysis.

The earliest symptom of the onset of this disease is the occurrence of an unusual red skin rash. This is commonly the first indication since it has been evidenced that many persons who have contracted this disease were, in fact, unaware that they had been bitten. This rash can appear at the site of the bite anywhere from several days to a few weeks after the bite. It typically starts as a small red spot, and then expands as the spirochetes expand from the bite location. Rash sizes can vary, but have been most commonly associated in a 2 to 3 inch diameter size range. This rash will fade (with or without treatment) after a few weeks. Close inspection is necessary to detect this symptom as the rashes are easy to miss because they're often very faint. Body sites where rashes frequently occur include the thigh areas, groin, and armpits. Also, it is not uncommon for a rash to develop in more than one place.

Other early symptoms include profound fatigue, a stiff neck, and flu-like symptoms such as headache, chills, fever, and muscle aches. Recognition of the onset of any of these symptoms is important since tick bites do not always produce a rash. If left untreated, the disease will progress to its second stage within weeks or months after the infection. This stage involves affects to the heart and nervous system. A common second stage symptom is a paralysis on one or both sides of the face. Others include severe headache, encephalitis, or meningitis. The third and final stage involves the development of chronic inflammatory arthritis, which can occur up to a year or more after the bite.

Evaluation

Evaluation of this hazard potential principally involves field personnel performing close self-inspections for the presence of ticks each time they leave the site. This should involve careful examination, especially of the individuals' heads. Personnel should be aware that when a tick attaches itself to its host, it inserts its entire head under the surface of the skin.

Control

Control of this threat involves several components. First, field personnel must be aware of the climate and area conditions which are commonly associated with being conducive to tick infestation. Second, when working in or walking through potential infested areas, personnel must ensure that they do not have exposed body parts (i.e. at least long sleeved shirts and long pants, particularly when protective coveralls are not worn). In heavily vegetated areas where infestation is likely, Tyvek coveralls will be required to minimize this hazard potential. Also, several commercial products have been demonstrated as being effective in repelling ticks. Examples include Permanone, Off!, and Cutter. These types of repellents will be used at the direction and discretion of the Tetra Tech NUS Health and Safety Officer, and only in accordance and observation of manufacturer's recommendations. In most instances, however, such repellents are typically applied to the outside surfaces of clothing (and not directly onto the skin), and should be applied also to shoe tops, socks, pants cuffs, and other areas most susceptible to ticks.

Tick Removal

In the event that a tick is discovered to be attached to a member of the field team, timely removal of the insect is critical to reducing the potential for contracting the disease. According to available information and research, there is apparently a grace period of at least a few hours from the time of the bite before the tick transmits the microbe (the spirochetes are not present in the mouth parts of the tick). However, the incident of a tick bite is frequently unnoticed, and the discovery of the tick may not occur until after this suspected grace period has already elapsed. Therefore, timely removal is very important. The preferred method of tick removal is to pull it out using tweezers or small forceps. In this method, the tick should be grasped as close to the mouth as possible, and then pulled steadily upward. Care must be exercised so as not to pull in a jerking motion as this can result in the head becoming detached. After the tick has been removed, disinfect the bite with rubbing alcohol or povidone iodine (Betadine). The tick must not be handled as the microbes can enter the body through any breaks in intact skin. The bite should be checked occasionally for at least a two-week period to see if a rash forms. If it does, medical attention must be promptly sought.

In order to provide for proper and timely response to the occurrence of a tick bite, the SSO will ensure that the site First Aid kit is properly equipped with medical forceps and rubbing alcohol, in addition to the standard kit contents. Also, an adequate supply of commercial insect (tick) repellents will be maintained on-site, and all personnel will be trained in its proper application and will be required to use it, at the direction of FOL.

ATTACHMENT III

EQUIPMENT INSPECTION CHECKLIST

EQUIPMENT INSPECTION

COMPANY:______________________ **UNIT NO.**______________
FREQUENCY: Inspect daily, document prior to use and as repairs are needed.

Inspection Date: ____/____/____ Time: _______ Equipment Type:______________________
(e.g., bulldozer)

	Good	Need Repair	N/A
Tires or tracks	❐	❐	❐
Hoses and belts	❐	❐	❐
Cab, mirrors, safety glass	❐	❐	❐
- Turn signals, lights, brake lights, etc. (front/rear) for equipment approved for highway use?	❐	❐	❐
- Is the equipment equipped with audible back-up alarms and back-up lights?	❐	❐	❐
Horn and gauges	❐	❐	❐
Brake condition (dynamic, park, etc.)	❐	❐	❐
Fire extinguisher (Type/Rating -____________)	❐	❐	❐
Fluid Levels:			
- Engine oil	❐	❐	❐
- Transmission fluid	❐	❐	❐
- Brake fluid	❐	❐	❐
- Cooling system fluid	❐	❐	❐
- Windshield wipers	❐	❐	❐
- Hydraulic oil	❐	❐	❐
Oil leak/lube	❐	❐	❐
Coupling devices and connectors	❐	❐	❐
Exhaust system	❐	❐	❐
Blade/boom/ripper condition	❐	❐	❐
Accessways: Frame, hand holds, ladders, walkways (non-slip surfaces), guardrails?	❐	❐	❐
Power cable and/or hoist cable	❐	❐	❐
Steering (standard and emergency)	❐	❐	❐

Safety Guards:	**Yes**	**No**
– Around rotating apparatus (belts, pulleys, sprockets, spindles, drums, flywheels, chains) all points of operations protected from accidental contact?______________	❐	❐
– Hot pipes and surfaces exposed to accidental contact?______________	❐	❐
– All emergency shut offs have been identified and communicated to the field crew?______________	❐	❐
– Have emergency shutoffs been field tested? ______________	❐	❐
– Results?______________	❐	❐
– Are any structural members bent, rusted, or otherwise show signs of damage?______________	❐	❐
– Are fueling cans used with this equipment approved type safety cans?______________	❐	❐

- Have the attachments designed for use (as per manufacturer's recommendation) with this equipment been inspected and are considered suitable for use?________________ ❐ ❐

Portable Power Tools:

- Tools and Equipment in Safe Condition?________________ ❐ ❐
- Saw blades, grinding wheels free from recognizable defects (grinding wheels have been sounded)?________________ ❐ ❐
- Portable electric tools properly grounded?________________ ❐ ❐
- Damage to electrical power cords?________________ ❐ ❐
- Blade guards in place?________________ ❐ ❐
- Components adjusted as per manufacturers recommendation?________________ ❐ ❐

Cleanliness:

- Overall condition (is the decontamination performed prior to arrival on-site considered acceptable)?____________
- Where was this equipment used prior to its arrival on site?________________
- Site Contaminants of concern at the previous site?________________
- Inside debris (coffee cups, soda cans, tools and equipment) blocking free access to foot controls?____________

Operator Qualifications (as applicable for all heavy equipment):

- Does the operator have proper licensing where applicable, (e.g., CDL)?________________
- Does the operator, understand the equipments operating instructions?________________
- Is the operator experienced with this equipment? ________________
- Does the operator have emotional and/or physical limitations which would prevent him/her from performing this task in a safe manner?________________
- Is the operator 21 years of age or more?________________

Identification:

- Is a tagging system available, for positive identification, for tools removed from service?___

Additional Inspection Required Prior to Use On-Site

	Yes	No
– Does equipment emit noise levels above 90 decibels?	❐	❐
– If so, has an 8-hour noise dosimetry test been performed?	❐	❐

- Results of noise dosimetry:________________
- Defects and repairs needed:________________
- General Safety Condition: ________________
- Operator or mechanic signature:________________

Approved for Use: ❐ Yes ❐ No

____
Site Safety Officer Signature

ATTACHMENT IV

SAFE WORK PERMITS

SAFE WORK PERMIT FOR
SOIL BORINGS AND WELL INSTALLATION

Permit No. ______________ Date: ________________ Time: From ____________ to ____________

SECTION I: General Job Scope

I. Work limited to the following (description, area, equipment used): Soil borings using hollow-stem augers and Direct Push Technology techniques. Monitoring well installation is included in this task.

II. Required Monitoring Instruments: FID or PID

III. Field Crew: ______________________________

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector ____________ ____________
TtNUS

SECTION II: General Safety Requirements (To be filled in by permit issuer)

IV. Protective equipment required
Level D ☒ Level B ☐
Level C ☐ Level A ☐
Detailed on Reverse

Respiratory equipment required
Full face APR ☐
Half face APR ☐
SKA-PAC SAR ☐
Skid Rig ☐
Escape Pack ☐
SCBA ☐
Bottle Trailer ☐
None ☒

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety shoes, safety glasses, hardhat, hearing protection, and nitrile gloves or leather gloves with surgical-style inner gloves.

V. Chemicals of Concern	Action Level(s)	Response Measures
Potential site contaminants include VOCs, SVOCs, metals, and pesticides	Any sustained readings 10 ppm above background in worker breathing zones.	Suspend site activities and report to an unaffected area.

VI. Additional Safety Equipment/Procedures

	Yes	No		Yes	No
Hard-hat	☒	☐	Hearing Protection (Plugs/Muffs)	☒	☐
Safety Glasses	☒	☐	Safety belt/harness	☐	☒
Chemical/splash goggles	☐	☒	Radio	☐	☒
Splash Shield	☐	☒	Barricades	☐	☒
Splash suits/coveralls	☐	☒	Gloves (Type - Nitrile)	☒	☐
Steel toe Work shoes or boots	☒	☐	Work/rest regimen	☐	☒

Modifications/Exceptions: Reflective vests for high traffic areas. Tyvek coverall and impermeable boots if there is a potential for soiling work clothes.

VII. Procedure review with permit acceptors

	Yes	NA		Yes	NA
Safety shower/eyewash (Location & Use)	☐	☐	Emergency alarms	☐	☐
Procedure for safe job completion	☐	☐	Evacuation routes	☐	☐
Contractor tools/equipment/PPE inspected	☐	☐	Assembly points	☐	☐

VIII. Equipment Preparation

	Yes	NA
Equipment drained/depressurized	☐	☐
Equipment purged/cleaned	☐	☐
Isolation checklist completed	☐	☐
Electrical lockout required/field switch tested	☐	☐
Blinds/misalignments/blocks & bleeds in place	☐	☐
Hazardous materials on walls/behind liners considered	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.) ☐ Yes ☐ No
If yes, complete permit required or contact Health Sciences, Pittsburgh Office

X. Special instructions, precautions: Avoid generating significant concentrations of airborne dusts.

Permit Issued by: ______________________ Permit Accepted by: ______________________

SAFE WORK PERMIT FOR
MULTI-MEDIA SAMPLING

Permit No. ______________ Date: ________________ Time: From ____________ to ____________

SECTION I: General Job Scope

I. Work limited to the following (description, area, equipment used): **Multi-media sampling including groundwater and soils. IDW sampling is also included in this task.**

II. Required Monitoring Instrument(s): PID or FID

III. Field Crew: ______________________________

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector ____________ ____________ TtNUS

SECTION II: General Safety Requirements (To be filled in by permit issuer)

IV. Protective equipment required

Level D ☒ Level B ☐
Level C ☐ Level A ☐
Detailed on Reverse

Respiratory equipment required

Full face APR	☐	Escape Pack	☐
Half face APR	☐	SCBA	☐
SKA-PAC SAR	☐	Bottle Trailer	☐
Skid Rig	☐	None	☒

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety shoes, surgical style gloves, and safety glasses. Hard hats and hearing protection will be worn when working near operating equipment or when required by the SSO.

V. Chemicals of Concern	Action Level(s)	Response Measures
Site contaminants include VOCs, SVOCs, metals, and pesticides	Any sustained readings 10 ppm above background in worker breathing zones.	Suspend site activities and report to an unaffected area.

VI. Additional Safety Equipment/Procedures

Hard-hat	☐ Yes	☒ No	Hearing Protection (Plugs/Muffs)	☐ Yes	☒ No
Safety Glasses	☐ Yes	☒ No	Safety belt/harness	☐ Yes	☒ No
Chemical/splash goggles	☐ Yes	☒ No	Radio	☐ Yes	☒ No
Splash Shield	☐ Yes	☒ No	Barricades	☐ Yes	☒ No
Splash suits/coveralls	☐ Yes	☒ No	Gloves (Type - Nitrile)	☒ Yes	☐ No
Steel toe Work shoes or boots	☒ Yes	☐ No	Work/rest regimen	☐ Yes	☒ No

Modifications/Exceptions: Reflective vests for high traffic areas. Tyvek coverall if there is a potential for soiling work cloths

VII. Procedure review with permit acceptors

	Yes	NA		Yes	NA
Safety shower/eyewash (Location & Use)	☐	☐	Emergency alarms	☐	☐
Procedure for safe job completion	☐	☐	Evacuation routes	☐	☐
Contractor tools/equipment/PPE inspected	☐	☐	Assembly points	☐	☐

VIII. Equipment Preparation

	Yes	NA
Equipment drained/depressurized	☐	☐
Equipment purged/cleaned	☐	☐
Isolation checklist completed	☐	☐
Electrical lockout required/field switch tested	☐	☐
Blinds/misalignments/blocks & bleeds in place	☐	☐
Hazardous materials on walls/behind liners considered	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.) ☐ Yes ☐ No
If yes, complete permit required or contact Health Sciences, Pittsburgh Office

X. Special instructions, precautions: .

Permit Issued by: ______________________ Permit Accepted by: ______________________

ATTACHMENT V

HEAT STRESS

HEAT STRESS

Because some physically demanding field work is expected to take place during warmer months or periods, heat related disorders are a potential problem. Discussed below are the common heat-related disorders and the recommended actions to prevent heat stress.

Heat Related Disorders

Heat Rash

Also known as prickly heat, this condition affects the skin. It occurs in situations where the skin remains wet most of the time. The sweat ducts become plugged and a skin rash soon appears.

Signs and Symptoms

- Skin rash will appear on affected areas of the body.
- Tingling or prickling sensation will be felt on the affected areas.

Heat Cramps

Heat cramps are muscle pains, usually in the lower extremities, the abdomen, or both, that occur after profuse sweating with accompanying salt depletion. Heat cramps most often afflict people in good physical condition, who overwork in conditions of high temperature and humidity. Untreated, heat cramps may progress to heat exhaustion.

Signs and Symptoms

- Cramps in the extremities and abdomen that begin suddenly during vigorous activity. Heat cramps can be mild with only slight abdominal cramping and tingling in the extremities, but more commonly present intense and incapacitating pain in the abdomen and extremities.
- Respiration rate will increase, decreasing after the pain subsides.
- Pulse rate will increase
- Skin will be pale and moist.
- Body temperature will be normal
- Generalized weakness will be noted as the pain subsides.
- Loss of consciousness and airway maintenance are seldom problems with this condition.

Treatment for heat cramps is aimed at eliminating the exposure and restoring the loss of salt and water.

Heat Exhaustion

Heat exhaustion is a more severe response to salt and water loss, as well as an initial disturbance in the body's heat-regulations system. Like heat cramps, heat exhaustion tends to occur in people working in hot environments. Heat exhaustion may progress to heat stroke. Treatment for heat exhaustion is similar in principle to that for heat cramps.

Signs and Symptoms

- Heat exhaustion may be accompanied present by a headache, fatigue, dizziness, or nausea with occasional abdominal cramping. More severe cases of heat exhaustion may resulting partial or complete temporary loss of respiration nd circulation due to cerebral ischemia.

- Sweating will be profuse.

- Pulse rate will be rapid and weak.

- Respiration rate will be rapid and shallow.

- The skin will be pale and clammy

- The body temperature will be normal or decreased.

- The person could be irritable and restless.

Heat Stroke

Heat stroke is caused by a severe disturbance in the body's heat-regulating system and is a profound emergency: The mortality rate ranges from 25 to 50 percent. It is most common in men over 40, especially alcoholics. It can also occur to people of any age having too much exposure to the sun or prolonged confinement in a hot atmosphere. Heat stroke comes on suddenly. As the sweating mechanism fails, the body temperature begins to rise precipitously, reaching 106°F (41°C) or higher within 10 to 15 minutes. If the situation is not corrected rapidly, the body cells -- especially have very vulnerable cells to the brain--are literally cooked, and the central nervous system is irreversibly damaged. The treatment for heat stroke is aimed at maintaining vital functions and causing as rapid a decrease of body temperature as possible.

Signs and Symptoms

- The person's pulse will be strong and bounding.
- The skin will be hot, dry, and flushed.
- The worker may experience headache, dizziness, and dryness of mouth
- Seizures and coma can occur.
- Loss of consciousness and airway maintenance problems can occur.

These are only guidelines for heat related emergencies. Actual training in emergency medical care or basic first aid is recommended.

<u>Controlling Heat Stress</u>

The SSO shall visually monitor personnel to note for signs of heat stress. Field personnel will also be instructed to observe for symptoms of heat stress and methods on how to control it. One or more of the following control measures can be used to help control heat stress:

- Provide adequate liquids to replace lost body fluids. Personnel must replace water and salt lost from sweating. Personnel must be encouraged to drink more than the amount required to satisfy thirst. Thirst satisfaction is not an accurate indicator of adequate salt and fluid replacement.

- Replacement fluids can be commercial mixes such as Gatorade®.

- Establish a work regime that will provide adequate rest periods for cooling down. This may require additional shifts of workers.

- Cooling devices such as vortex tubes or cooling vests can be worn beneath protective garments.
- Breaks are to be taken in a cool rest area (77°F is best).
- Personnel shall remove impermeable protective garments during rest periods.
- Personnel shall not be assigned other tasks during rest periods.
- Personnel shall be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress.

The heat stress of personnel onsite may be monitored utilizing biological monitoring.

One of the following biological monitoring procedures may be utilized by the SSO to monitor heat stress concerns.

- Heart rate (HR) shall be measured by the pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats/minute. If the HR is higher, the next work period should be shortened by 10 minutes (or 33 percent), while the length of rest period stays the same. If the pulse rate is 100 beats/minute at the beginning of the next rest period, the following work cycle should be shortened by 33 percent. The length of the initial work period will be determined by using the table below.

PERMISSIBLE HEAT EXPOSURE THRESHOLD LIMIT VALUES

	Work Load		
Work-Rest Regimen	Light	Moderate	Heavy
Continuous	80.0°F	80.0°F	77.0°F
75% Work - 25% Rest, Each Hour	87.0°F	82.4°F	78.6°F
50% Work - 50% Rest, Each Hour	88.5°F	85.0°F	82.2°F
25% Work - 75% Rest, Each Hour	90.0°F	88.0°F	86.0°F

- Body temperature shall be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature at the beginning of the rest period should not exceed 99°F. If it does, the next work period should be shortened by 10 minutes (or 33 percent), while the length of the rest period stays the same. However, if the oral temperature exceeds 99.7°F at the beginning of the next rest period, the following work cycle shall be further shortened by 33 percent. OT should be measured at the end of the rest period to make sure that it has dropped below 99°F. At no time shall work begin with the oral temperature above 99°F.

NOTE: External temperatures in excess of those stated above shall be regarded as inclement weather. Work continuation, termination, or alteration of the work schedule will be at the discretion of the FOL or SSO.

APPENDIX F

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

REMEDIAL INVESTIGATIONI/FEASIBILITY STUDY
FOR
SITES 5, 7, 29,35, 38, 39, 40 AND PSC1485C

NAVAL AIR STATION – WHITING FIELD
MILTON, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:
Tetra Tech NUS, Inc.
661 Andersen Drive
Foster Plaza 7
Pittsburgh, Pennsylvania 15220

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER CTO 0079

JANUARY 2000

PREPARED UNDER THE SUPERVISION OF:

TERRY HANSEN
TASK ORDER MANAGER
TETRA TECH NUS, INC.
TALLAHASSEE, FLORIDA

APPROVED FOR SUBMITTAL BY:

Paul V. Frank

PAUL V. FRANK
QUALITY ASSURANCE MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

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APPENDIX

ACRONYMS/ABBREVIATIONS

ASTM	American Society for Testing and Materials
TtNUS	Tetra Tech NUS, Inc.
BFB	Bromofluorobenzene
CLEAN	Comprehensive Long-Term Environmental Action, Navy
COC	Chain of Custody
CompQAP	Tetra Tech NUS, Inc. FDEP Comprehensive Quality Assurance Plan
CTO	Contract Task Order
CVAA	Cold Vapor Atomic Absorption
DFTPP	Decaflourotriphenyl phosphine
DQO	Data Quality Objective
FDEP	Florida Department of Environmental Protection
FID	Flame Ionization Detector
FOL	Field Operations Leader
FTMR	Field Task Modification Request
GC	Gas Chromatograph
GFAA	Graphite Furnace Atomic Absorption
HASP	Health & Safety Plan
ICP	Inductively Coupled Plasma
LCS	Laboratory Control Sample
MS	Mass Spectrometer
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NFESC	Naval Facilities Engineering Service Center
NIST	National Institute of Science and Technology
NAS – Whiting Field	Naval Air Station Whiting Field
PARCC	Precision, Accuracy, Representativeness, Comparability, Completeness
PEM	Performance Evaluation Mixture
PQL	Practical Quantitation Limit
QA	Quality Assurance
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	Quality Control
RDL	Required Detection Limit
REDOX	Oxidation-Reduction Potential
RQL	Required Quantitation Limit
RPD	Relative Percent Difference
SOP	Standard Operating Procedure
SOW	Statement of Work
TAL	Target Analyte List
TCL	Target Compound List
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
%R	Percent Recovery

1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared by Tetra Tech NUS, Inc (TtNUS) on behalf of the United States Navy Southern Division Naval Facilities Engineering Command and the Naval Air Station Whiting Field (NAS-Whiting Field), Milton, Florida, under the Comprehensive Long-Term Environmental Action Navy (CLEAN III) Contract Number N62467-94-D-0888, Contract Task Order (CTO) 086. The QAPP and other associated documents, including the TtNUS Florida Department of Environmental Protection (FDEP) approved Comprehensive Quality Assurance Plan (CompQAP) No. 980038, dated August 24, 1998, RI/FS Sampling and Analysis Plan (SAP), prepared by TtNUS, dated March 1999 and the Health and Safety Plan (HASP), constitute the project planning documents for the Remedial Investigation/Feasibility Study (RI/FS) program to be performed at sites 5, 7, 29, 35, 38, 39, 40, and PSC 1485C, Milton, Florida.

This QAPP presents the organization, objectives, planned activities, and specific Quality Assurance/Quality Control (QA/QC) procedures associated with the RI/FS program. Specific protocols for sampling, sample handling and storage, chain-of-custody, and laboratory and field analyses are described within this document. All QA/QC procedures are structured in accordance with applicable technical standards, the Naval Facilities Engineering Service Center (NFESC) guidance document "Navy Installation Restoration Laboratory Quality Assurance Guide (February 1996), and United States Environmental Protection Agency (USEPA) Region IV and FDEP requirements, regulations, guidance, and technical standards.

1.2 FACILITY DESCRIPTION

A description of sites 5, 7, 29, 35, 38, 39, 40, and PSC 1485C at NAS-Whiting Field, including its location, size and borders, site conditions, natural and man-made features, and zones of investigation, is provided in Section 3 of the RI/FS Work Plan.

1.3 PROJECT OBJECTIVES

This section discusses the overall project objectives, the anticipated target parameters and intended data uses for both field and laboratory analytical data.

1.3.1 Overall Project Objectives

The overall objectives of the work will be to perform a RI/FS of the surface water, groundwater, surface soil, subsurface soil, sediments located at the sites. Project objectives are discussed in more detail in Section 3 of the RI/FS Work Plan.

1.3.2 Project Target Parameters and Intended Data Uses

This section discusses the field and laboratory analytical information to be generated during the course of the RI/FS. Field parameters and intended data uses are discussed in Section 1.3.2.1. Laboratory parameters and intended data uses are discussed in Section 1.3.2.2.

1.3.2.1 Field Parameters

Field parameters will include those parameters associated with groundwater and surface water sampling and analysis. All field measurements will be completed using simple field instrumentation or field test kits.

Field parameters including pH, specific conductance, turbidity and temperature will be completed for all groundwater samples. These measurements will be used to support monitoring well purging of stagnant water from well casings. Specific conductance and pH will also be used as general indicators of water quality. In addition, all groundwater samples will be analyzed for dissolved oxygen, oxidation-reduction (REDOX) potential, and ferrous iron. Ferrous iron will be measured using a field test kit. Turbidity will be measured using a Turbidity meter. The remaining field parameters will be measured using a meter with a flow-through cell. These additional parameters, along several laboratory parameters, will be used to assess the potential for natural attenuation of light non-aqueous phase liquids (LNAPL) in the groundwater system at the various sites. Surface water samples will not be subject to field measurements. Further details regarding field sampling methods are provided in Section 7.5 of TtNUS' CompQAP.

Samples will also be prescreened for volatile organic compounds using an Organic Vapor Analyzer (OVA). The OVA concentrations will be recorded on the chain of custody, and used by the laboratory to assist in volatile organic analysis.

1.3.2.2 Laboratory Parameters

The analytical methods to be used for analysis of the NAS-Whiting Field samples have been selected based on existing analytical data from previous investigations. The suite of analyses for the NAS-Whiting

Field RI/FS program includes Target Compound list (TCL) volatiles, TCL semivolatiles, TCL pesticides, Target Analyte List (TAL) metals, and Total Petroleum Hydrocarbons (TPH). These parameters will be used to evaluate the nature and extent of contamination, to evaluate contaminant migration pathways and likely source areas to potential receptors, to evaluate the progress of natural attenuation and to ensure the RI/FS program is protective of ecological and human health. Additional laboratory parameters, to be used in conjunction with the field parameters previously discussed, for the evaluation natural attenuation of LNAPL in the groundwater system, include nitrate/nitrite, sulfate, sulfide, ammonia, total kjeldehl nitrogen (TKN) and iron (total and dissolved). Tables 1-1 through 1-4 provide a summary of all target analytes and associated Required Quantitation Limits (RQL) for organics, Required Detection Limits (RDL) for metals, and typical Practical Quantitation Limits (PQLs) for all remaining parameters. Analytical methods are further discussed in Section 7.0 of this QAPP.

1.4 SAMPLE NETWORK DESIGN AND RATIONALE

The sample network design and rationale is discussed in detail in Section 3 of the RI/FS Work Plan. Figures displaying all proposed sampling locations are provided in Section 3 of the RI/FS Work Plan.

1.5 PROJECT SCHEDULE

The project schedule is discussed in Section 9 of the project RI/FS Work Plan.

Table 1-1
SW-846 8260B ANALYTICAL DETECTION LIMITS
CLP/TCL(3) VOLATILES LISTS
NAS – WHITING FIELD
PAGE 1 OF 2

Parameter	RQL(1)		Action Levels**		
	Solid Samples (4)	Groundwater / Freshwater Samples (3)	Solid Samples	Groundwater Samples	Freshwater Samples
Volatile Organic Compounds	µg/kg	µg/L	mg/kg	µg/L	µg/L
Acetone	10	5.0/5.0	780	700	1692
Benzene	10	1.0(2)/1.0	1.1	1.0	71.28
Bromodichloromethane	10	1.0/1.0	1.4	0.6	22
Bromoform	10	1.0/1.0	48	4.4	360
Bromomethane	10	1.0/1.0	2.2	9.8	35
2-Butanone	10	5.0/5.0	3100	4200	120000
Carbon disulfide	10	1.0/1.0	200	700	105
Carbon tetrachloride	10	1.0/1.0	0.4	3.0	4.42
Chlorobenzene	10	1.0/1.0	30	100	17
Chloroethane	10	1.0/1.0	2.9	12	NA
Chloroform	10	1.0/1.0	0.4	5.7	470.8
Chloromethane	10	1.0/1.0	1.7	2.7	470.8
Dibromochloromethane	10	1.0/1.0	1.4	0.4	34
1,2-Dibromoethane	10	1.0/1.0	0.01	0.02	13
1,1-Dichloroethane	10	1.0/1.0	290	70	NA
1,2-Dichloroethane	10	1.0(2)/1.0	0.5	3.0	5.0
1,1-Dichloroethene	10	1.0(2)/1.0	0.09	7.0	3.2
1,2-Dichloroethene (total)	10	10/10	NA*	NA	NA
1,2-Dichloropropane	10	1.0/1.0	0.6	5.0	2600
cis-1,3-Dichloropropene	10	1.0/1.0	0.2	0.2	12
trans-1,3-Dichloropropene	10	1.0/1.0	0.2	0.2	12
Ethylbenzene	10	1.0/1.0	1100	30	605
2-Hexanone	10	5.0/5.0	5.1	280	NA
4-Methyl-2-pentanone	10	5.0/5.0	220	560	23000
Methylene chloride	10	2.0/2.0	16	50	1580
Styrene	10	1.0/1.0	2700	100	455
1,1,2,2-Tetrachloroethane	10	1.0/1.0	0.7	0.2	10.8
1,1,1-Trichloroethane	10	1.0/1.0	400	200	270

SW-846 8260B ANALYTICAL DETECTION LIMITS
CLP/TCL[3] VOLATILES LISTS
NAS – WHITING FIELD
PAGE 2 OF 2

Parameter	RQL[1]		Action Levels**		
	Solid Samples	Groundwater / Freshwater Samples	Solid Samples	Groundwater Samples	Freshwater Samples
Volatile Organic Compounds	**µg/kg**	**µg/L**	**mg/kg**	**ug/L**	**ug/L**
1,1,2-Trichloroethane	10	1.0/1.0	1.3	5.0	28.5
Trichloroethene	10	**1.0**[2]/1.0	**6.0**	**3.0**	**80.7**
Tetrachloroethene	10	1.0/1.0	8.9	3.0	8.85
Toluene	10	1.0/1.0	380	40	475
Vinyl chloride	10	**1.0**[2]/1.0	**0.03**	**1.0**	**NA**
Xylenes (total)	10	1.0/1.0	5900	20	370

PQL Practical Quantitation Limit
1 RQL Required Maximum Quantitation Limit
2 COC Chemicals historically present at the site (Chemical of Concern)
3 CLP/TCL U.S. Environmental Protection Agency Contract Laboratory Program Target Compound List OLM03.2
** As provided in Chapter 62-777, F.A.C.
NA Not Applicable
NA* Not Available

Table 1-2
SW-846 8270C ANALYTICAL DETECTION LIMITS
CLP/TCL[3] LISTS
NAS – WHITING FIELD
PAGE 1 OF 2

Parameter	RQL[1]		Action Levels**		
	Solid Samples	Groundwater / Freshwater Samples	Solid Samples	Groundwater Samples	Freshwater Samples
Semivolatile Organic Compounds	**µg/kg**	**µg/L**	**mg/kg**	**µg/L**	**µg/L**
Bis(2-chloroethoxy)methane	330	10/10	NA*	NA*	NA*
Bis(2-chloroethyl)ether	300	4.0/9.0	0.3	4.0	9.99
Bis(2-ethylhexyl)phthalate	330	6.0/0.02	76	6.0	0.02
4-Bromophenyl-phenylether	330	10/10	NA*	406	NA
Butylbenzylphthalate	330	10/10	15000	140	25.5
Carbazole	330	4.0/10	53	4.0	46.5
4-Chloro-3-methylphenol	330	10/10	410	63	100
4-Chloroaniline	330	10/2.0	190	28	2.5
2-Chloronaphthalene	330	10/10	4000	560	NA
2-Chlorophenol	330	10/10	82	35	130
4-Chlorophenyl-phenylether	330	10/10	NA*	NA*	NA*
Dibenzofuran	330	10/10	280	28	67
3,3'-Dichlorobenzidine	330	10/0.06	2.1	12	0.06
Diethylphthalate	330	10/10	54000	5600	380
Di-n-butylphthalate	330	10/10	7300	700	23
Di-n-octylphthalate	330	10/10	1500	140	NA
4,6-Dinitro-2-methylphenol	830	10/10	NA*	NA*	NA*
2,4-Dinitrophenol	830	10/3.0	66	14	3.0
2,4-Dinitrotoluene	330	0.1/9.0	1.3	0.1	9.1
1,2-Dichlorobenzene	330	10/10	650	200	99
1,3-Dichlorobenzene	330	10/10	27	10	85
1,4-Dichlorobenzene	330	10/10	6.0	75	100
2,4-Dichlorophenol	330	0.5/10	130	0.5	13
Dimethylphthalate	330	10/10	590000	70000	1450
2,4-Dimethylphenol	330	10/10	910	140	261
2,6-Dinitrotoluene	330	0.1/4.0	1.0	0.1	4.0
Hexachlorobenzene	330	1.0/0.00036	0.50	1.0	0.00036

Parameter	RQL(1)		Action Levels**		
	Solid Samples	Groundwater / Freshwater Samples	Solid Samples	Groundwater Samples	Freshwater Samples
Semivolatile Organic Compounds	**µg/kg**	**µg/L**	**mg/kg**	**µg/L**	**µg/L**
Hexachlorobutadiene	330	0.5/10	6.3	0.5	49.7
Hexachlorocyclopentadiene	330	10/2.0	2.4	50	2.95
Hexachloroethane	330	2.0/1.0	34	2.5	1.1
Isophorone	330	10/10	340	37	645
2-Methylphenol	330	10/10	2400	35	250
4-Methylphenol	330	4.0/10	250	4.0	70·
2-Nitroaniline	330	10/10	5.7	50	NA
3-Nitroaniline	830	10/10	NA*	50	NA
4-Nitroaniline	830	10/10	5.2	21	1200
Nitrobenzene	330	4.0/10	14	4.0	90
2-Nitrophenol	330	10/10	NA*	NA*	NA*
4-Nitrophenol	830	10/10	390	56	55
N-nitroso-di-n-propylamine	90	4.0/0.83	0.09	4.0	0.83
N-nitrosodiphenylamine	330	7.1/10	170	7.1	44
Oxybis(1-chloropropane)	330	10/10	NA*	NA*	NA*
ntachlorophenol	830	1.0/8.0	7.7	1.0	8.2
Phenol	330	10/6.5	900	10	6.5
1,2,4-Trichlorobenzene	330	10/10	560	70	22.5
2,4,5-Trichlorophenol	830	4.0/10	6000	4.0	22.5
2,4,6-Trichlorophenol	330	3.2/6.0	72	3.2	6.5

PQL Practical Quantitation Limit
1 RQL Required Maximum Quantitation Limit
2 COC Chemicals historically present at the site (Chemical of Concern)
3 CLP TCL U.S. Environmental Protection Agency Contract Laboratory Program Target Compound List OLM03.2
** As provided in Chapter 62-777, F.A.C.
NA Not Applicable
NA* Not Available

Table 1-3
SW-846 8310 ANALYTICAL DETECTION LIMITS
CLP/TCL[3] LISTS
NAS – WHITING FIELD
PAGE 1 OF 1

Parameter	RQL[1]		Action Levels**		
	Solid Samples	Groundwater/ Freshwater Samples	Solid Samples	Groundwater Samples	Freshwater Samples
Polyaromatic Hydrocarbons	**µg/kg**	**µg/L**	**mg/kg**	**µg/L**	**µg/L**
Acenaphthylene	330	10/0.031	1100	210	0.031
Acenaphthene	330	10/3.0	1900	20	3.0
Anthracene	330	10/0.30	18000	2100	0.30
Benzo(a)anthracene	330	0.2/0.031	1.4	0.2	0.031
Benzo(B)fluoroanthene	330	0.2/0.031	1.4	0.2	0.031
Benzo(K)fluoroanthene	33	0.5/0.031	15	0.5	0.031
Benzo(A)pyrene	330	0.2/0.031	0.1	0.2	0.031
Benzo(g,h,I)perylene	330	10/0.031	2300	210	0.031
Chrysene	330	4.8/0.031	140	4.8	0.031
Dibenzo(A,H)anthracene	330	0.2/0.031	0.1	0.2	0.031
Fluoroanthene	330	10/0.030	2900	280	0.30
Flourene	330	10/10	2200	280	30
Indeno(1,2,3-CD)pyrene	330	0.2/0.031	1.5	0.2	0.031
2-Methylnaphthalene	330	10/10	80	20	30
Naphthalene	330	10/10	40	20	26
Phenanthrene	330	10/0.031	2000	210	0.031
Pyrene	330	10/0.30	2200	210	0.30

PQL Practical Quantitation Limit
1 RQL Required Maximum Quantitation Limit
2 COC Chemicals historically present at the site (Chemical of Concern)
3 CLP TCL U.S. Environmental Protection Agency Contract Laboratory Program Target Compound List OLM03.2
** As provided in Chapter 62-777, F.A.C.
NA Not Applicable
NA* Not Available

Table 1-4
SW-846 8081A ANALYTICAL DETECTION LIMITS
CLP/TCL(3) LISTS
NAS – WHITING FIELD
PAGE 1 OF 1

Parameter	RQL(1)		Action Levels**		
	Solid Samples	Groundwater / Freshwater Samples	Solid Samples	Groundwater Samples	Freshwater Samples
Pesticides	µg/kg	µg/L	mg/kg	µg/L	µg/L
ldrin	1.7	0.005/0.00010	0.07	0.005	0.00014
lpha-Benzene hexachloride (BHC)	1.7	0.05/0.05	NA*	NA*	NA*
lpha-Chlordane	1.7	0.05/0.00050	3.1	2.0	0.00059
eta-BHC	1.7	0.1/0.1	NA*	NA*	NA*
,4'-DDE	3.3	0.1/0.0005	3.3	0.1	0.0006
,4'-DDD	3.3	0.1/0.003	4.6	0.1	0.003
,4'-DDT	3.3	0.1/0.00059	3.3	0.1	0.00059
elta-BHC	1.7	0.05/0.05	NA*	NA*	NA*
ieldrin	3.3	0.005/0.00014	0.07	0.005	0.00014
ndosulfan I	1.7	0.05/0.05	410	42	0.056
ndosulfan II	3.3	0.0500.05	410	42	0.056
ndosulfan sulfate	3.3	0.1/0.1	NA*	NA*	NA*
ndrin	3.3	0.1/0.0020	21	2.0	0.0023
.ldehyde	3.3	0.1/0.1	NA*	NA*	NA*
ndrin ketone	3.3	0.1/0.1	NA*	NA*	NA*
amma-BHC (Lindane)	1.7	0.05/0.05	NA*	NA*	NA*
amma-Chlordane	1.7	0.05/0.00059	3.1	2.0	0.00059
eptachlor	1.7	0.05/0.0021	0.2	0.4	0.0021
eptachlor epoxide	1.7	0.1/0.001	0.1	0.2	0.002
ethoxychlor	17	0.4/0.03	370	40	0.03
oxaphene	170	1.0/0.0002	1.0	3.0	0.0002

PQL Practical Quantitation Limit
1 RQL Required Maximum Quantitation Limit
2 COC Chemicals historically present at the site (Chemical of Concern)
3 CLP TCL U.S. Environmental Protection Agency Contract Laboratory Program Target Compound List OLM03.2

** As provided in Chapter 62-777, F.A.C.

NA Not Applicable

NA* Not Available

Table 1-5
SW-846 8082 ANALYTICAL DETECTION LIMITS
CLP/TCL[3] LISTS
NAS – WHITING FIELD
PAGE 1 OF 1

Parameter	RQL[1]		Action Levels**		
	Solid Samples	Groundwater / Freshwater Samples	Solid Samples	Groundwater Samples	Freshwater Samples
Pesticides	**µg/kg**	**µg/L**	**mg/kg**	**µg/L**	**µg/L**
Aroclor-1016	33	0.5/0.000045	17	0.5	0.000045
Aroclor-1221	67	0.5/0.000045	17	0.5	0.000045
Aroclor-1232	33	0.5/0.000045	17	0.5	0.000045
Aroclor-1242	33	0.5/0.000045	17	0.5	0.000045
Aroclor-1248	33	0.5/0.000045	17	0.5	0.000045
Aroclor-1254	33	0.5/0.000045	17	0.5	0.000045
Aroclor-1260	33	0.5/0.000045	17	0.5	0.000045

PQL	Practical Quantitation Limit
1 RQL	Required Maximum Quantitation Limit
2 COC	Chemicals historically present at the site (Chemical of Concern)
3 CLP/TCL	U.S. Environmental Protection Agency Contract Laboratory Program Target Compound List OLM03.2

** As provided in Chapter 62-777, F.A.C.

Table 1-6
SW-846 6010B, 9010B, 7000A ANALYTICAL DETECTION LIMITS
CLP/TAL[3] LISTS and CYANIDE
NAS – WHITING FIELD
PAGE 1 OF 1

Parameter	RDL[1]	Action Levels**		
	Groundwater / Freshwater Samples	Groundwater Samples	Soil Samples	Freshwater Samples
Target Analyte List Metals	μg/L	μg/L	mg/kg	μg/L
Aluminum	200/13	200	72000	13
Antimony	6.0/6.0	6.0	26	4300
Arsenic	10/10	50	0.8	50
Barium	200/200	2000	110	NA
Beryllium	4.0/0.13	4.0	120	0.13
Cadmium	5.0/5.0	5.0	75	NA
Calcium	280/280	280	3100	NA*
Chromium (total)	10/10	100	210	NA*
Cobalt	50/50	420	4700	NA*
Copper	25/25	1000	110	NA
Iron	25/25	300	230000	1000
Lead	3.0/3.0	15	400	NA
Magnesium	5000/5000	NA*	NA*	NA
Manganese	15/15	50	1600	NA*
Mercury	0.2/0.12	2.0	3.4	0.012
Nickel	40/40	100	110	NA
Potassium	350/5.5	350	NA*	5.5
Selenium	5.0/5.0	50	390	5.0
Silver	10/0.07	100	390	0.07
Sodium	5000/5000	160000	NA*	NA
Thallium	2.0/2.0	2.0	NA*	6.3
Vanadium	49/49	49	15	NA*
Cyanide	1.0/1.0	200	30	5.2
Zinc	20/20	5000	230000	NA

PQL Practical Quantitation Limit
1 RQL Required Maximum Quantitation Limit – Detection Limit expressed as Instrument Detection Limit obtained in pure water. Detection Limit for soil adjusted for the amount sample analyzed and percent moisture.
2 COC Chemicals historically present at the site (Chemical of Concern)
3 CLP/TAL U.S. Environmental Protection Agency Contract Laboratory Program Target Analyte List ILM04.0
** As provided in Chapter 62-77, F.A.C.
NA* Not Available

Table 1-7
Analytical Detection Limits – natural Attenuation Parameters
NAS- Whiting Field, Milton, Florida
Page 1 of 1

Parameter	PQL [1]
	Groundwater Samples
	mg/L
Nitrate	0.050
Sulfate	1.0
Sulfide	1.0
Chloride	1.0
Methane, Ethane, Ethene	5.0
Total Organic Carbon	1.0
Dissolved Organic Carbon	1.0

(1) PQL Typical Practical Quantitation Limit; actual PQL may vary based on the Laboratory

2.0 PROJECT ORGANIZATION

The project organization for the NAS-Whiting Field RI/FS program is discussed in the Health and Safety Plan for the RI/FS Work Plan.

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective for this project is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results which are legally defensible in a court of law. Intended data uses are described in Section 1.3.2 of this QAPP. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field and laboratory equipment, and corrective action are described in other sections of this QAPP.

The PARCC parameters (precision, accuracy, representativeness, comparability, and completeness) are qualitative and/or quantitative statements regarding the quality characteristics of the data used to support project objectives and ultimately, environmental decisions. These parameters are discussed in the remainder of this section. Specific routine procedures used to assess the quantitative parameters (precision, accuracy, and completeness) are provided in Section 12.0.

3.1 PRECISION

3.1.1 Definition

Precision is a measure of the amount of variability and bias inherent in a data set. Precision describes the reproducibility of measurements of the same parameter for samples under similar conditions. The equation for determining precision is provided in Section 12.2.

3.1.2 Field Precision Objectives

Field duplicates for aqueous matrix samples will not be required. In lieu of taking duplicate measurements and using independent QC check standards, more frequent continuing calibrations will be performed. Field precision is further discussed in Section 7.5 of TtNUS' CompQAP.

3.1.3 Laboratory Precision Objectives

Laboratory precision QC samples are analyzed at a frequency of 5 percent (i.e., one quality control sample per 20 environmental samples). Laboratory precision is measured via comparison of calculated RPD values and Precision Control Limits specified in the analytical method or by the laboratory's QA/QC Program.

With the exception of low-concentration volatiles analysis, precision for volatile and semivolatile organic analyses will be measured via the RPDs for matrix spike/matrix spike duplicate (MS/MSD) samples. The analytical method for low-concentration volatile analysis does not require a specific QC sample to monitor precision, the calibration requirements of the method (i.e., specific limits of precision for the calibration standards) do ensure that a sufficient level of precision is achieved. (Calibration is further discussed in Section 6.0.) Precision for metals analysis will be measured via RPDs for laboratory duplicates. Table 3-1 presents precision control limits for MS/MSD RPDs for organics. Table 3-2 presents precision control limits for laboratory duplicate RPDs for metals. Precision for the remaining parameters (i.e., natural attenuation and miscellaneous parameters) will typically be measured via the RPD results for laboratory duplicate samples. Internal laboratory control limits for precision, which are typically set at three times the standard deviation of a series of RPDs, will be used for evaluation of precision for these parameters.

3.2 ACCURACY

3.2.1 Definition

Accuracy is the degree of agreement between are observed value and an accepted reference value. The equation for determining accuracy is provided in Section 12.1.

3.2.2 Field Accuracy Objectives

The determination of accuracy in the field is not required. In lieu of taking duplicate measurements and using independent QC check standards, more frequent continuing calibrations will be performed. Field accuracy is further discussed in Section 7.5 of TtNUS' CompQAP.

3.2.3 Laboratory Accuracy Objectives

Accuracy in the laboratory is measured through the comparison of a spiked sample result against a known or calculated value expressed as a percent recovery (%R). Percent recoveries are derived from the analysis of known amounts of compounds spiked into deionized water [i.e., laboratory control sample (LCS) analysis], or into actual samples (i.e., surrogate or MS analysis). LCS analyses measure the accuracy of laboratory operations. Surrogate and MS analyses measure the accuracy of laboratory operations as affected by matrix. LCS and/or MS analyses are performed with a frequency of one per

TABLE 3-1

PRECISION CONTROL LIMITS (RPDs)[1]
MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLES
VOLATILE AND SEMIVOLATILE ORGANIC ANALYSIS[2]
NAS-WHITING FIELD, MILTON, FLORIDA

Chemical	Solid Samples	Aqueous Samples
VOLATILE ORGANICS		
1,1-Dichloroethene	22	22
Trichloroethene	24	24
Benzene	21	21
Toluene	21	21
Chlorobenzene	21	21
SEMIVOLATILE ORGANICS		
Phenol	35	42
2-Chlorophenol	50	40
1,4-Dichlorobenzene	27	28
N-Nitroso-di-n-propylamine	38	38
1,2,4-Trichlorobenzene	23	28
4-Chloro-3-methylphenol	33	42
Acenaphthene	19	31
4-Nitrophenol	50	50
2,4-Dinitrotoluene	47	38
Pentachlorophenol	47	50
Pyrene	36	31
PESTICIDES		
gamma-BHC (Lindane)	50	50
Heptachlor	31	31
Aldrin	43	43
Dieldrin	38	38
Endrin	45	45
4,4'-DDT	50	50

1 RPD - Relative Percent Difference as described in Section 12.0.
2 USEPA Methods SW-846 8260B and 8270C.

TABLE 3-2

PRECISION CONTROL LIMITS (RPDs)[1]
LABORATORY DUPLICATE SAMPLES
METALS ANALYSIS[2]
NAS-WHITING FIELD, MILTON, FLORIDA

Chemical	Aqueous Samples	Solid Samples
METALS		
Aluminum	20	35
Antimony	20	35
Arsenic	20	35
Barium	20	35
Beryllium	20	35
Cadmium	20	35
Calcium	20	35
Chromium (total)	20	35
Cobalt	20	35
Copper	20	35
Iron	20	35
Lead	20	35
Magnesium	20	35
Manganese	20	35
Mercury	20	35
Nickel	20	35
Potassium	20	35
Selenium	20	35
Silver	20	35
Sodium	20	35
Thallium	20	35
Tin	20	35
Vanadium	20	35
Zinc	20	35

1 RPD - Relative Percent Difference as described in Section 12.0.
2 USEPA Method SW-846 6010B

twenty associated samples of like matrix. Surrogate spike analysis is performed for all chromatographic organic analyses. Laboratory accuracy is assessed via comparison of calculated %Rs with Accuracy Control Limits specified in the analytical method or by the laboratory's QA/QC Program.

Accuracy for volatile and semivolatile organic analysis will be measured via the %Rs for surrogate spikes and MS/MSDs. Accuracy for metals analysis will be measured via %Rs for MSs and LCSs. Table 3-3 presents control limits for LCS and surrogate spike recoveries for low-concentration volatiles. Tables 3-4 and 3-5 present control limits for matrix and surrogate spike recoveries, respectively, for organics. Tables 3-6 and 3-7 present control limits for MS and LCSs, respectively, for metals. Accuracy for the remaining parameters will typically be measured via %Rs for MSs and/or LCSs. Internal laboratory control limits for accuracy, which are typically set at three times the standard deviation of a series of %R values, will be used for evaluation of accuracy for these parameters.

3.3 COMPLETENESS

Completeness is a measure of the amount of usable, valid analytical data obtained, compared to the amount expected to be obtained. Completeness is typically expressed as a percentage. The equation for completeness is presented in Section 12.3.

The ideal objective for completeness is 100 percent (i.e., every sample planned to be collected is collected; every sample submitted for analysis yields valid data). However, samples can be rendered unusable during shipping or preparation (e.g., bottles broken or extracts accidentally destroyed), errors can be introduced during analysis (e.g., loss of instrument sensitivity, introduction of ambient laboratory contamination), or strong matrix effects can become apparent (e.g., extremely low matrix spike recovery).

These instances result in data that do not meet QC criteria. Based on these considerations, 95 percent is considered an acceptable target for the data completeness objective. If critical data points are lost, resampling and/or reanalysis might be required.

As further discussed in Section 9.2, one hundred percent of the laboratory data for the NAS-Whiting Field RI/FS program will be validated. Data rejected as a result of the validation process will be treated as unusable data.

TABLE 3-3

ACCURACY CONTROL LIMITS (%R)[1]
LABORATORY CONTROL SAMPLE AND SURROGATE SPIKE
VOLATILE ORGANIC ANALYSIS[2]
NAS-WHITING FIELD, MILTON, FLORIDA

Chemical	Aqueous Samples
LABORATORY CONTROL SAMPLE	
Vinyl chloride	60-140
1,2-Dichloroethane	60-140
Carbon tetrachloride	60-140
1,2-Dichloropropane	60-140
Trichloroethene	60-140
1,1,2-Trichloroethane	60-140
Benzene	60-140
cis-1,3-Dichloropropene	60-140
Bromoform	60-140
Tetrachloroethene	60-140
1,2-Dibromoethane	60-140
1,4-Dichlorobenzene	60-140
SURROGATE SPIKE	
Bromoflourobenzene	80-120

1 %R - Percent Recovery as described in Section 12.0.
2 USEPA Method 8260B

TABLE 3-4

ACCURACY CONTROL LIMITS (%R)[1]
MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLES
VOLATILE AND SEMIVOLATILE ORGANIC ANALYSIS[2]
NAS-WHITING FIELD, MILTON, FLORIDA

Chemical	Solid Samples	Aqueous Samples
VOLATILE ORGANICS		
1,1-Dichloroethene	59-172	NA
Trichloroethene	62-137	NA
Benzene	66-142	NA
Toluene	59-139	NA
Chlorobenzene	60-133	NA
SEMIVOLATILE ORGANICS		
Phenol	26-90	12-110
2-Chlorophenol	25-102	27-123
1,4-Dichlorobenzene	28-104	36-97
N-Nitroso-di-n-propylamine	41.126	41-116
1,2,4-Trichlorobenzene	38-107	39-98
4-Chloro-3-methylphenol	26-103	23-97
Acenaphthene	31-137	46-118
4-Nitrophenol	11-114	10-80
2,4-Dinitrotoluene	28-89	24-96
Pentachlorophenol	17-109	9-103
Pyrene	35-142	26-127
PESTICIDES		
gamma-BHC (Lindane)	46-127	46-127
Heptachlor	35-130	35-130
Aldrin	34-132	34-132
Dieldrin	31-134	31-134
Endrin	42-139	42-139
4,4'-DDT	23-134	23-134

1 %R - Percent Recovery as described in Section 12.0
2 USEPA Method Sw-846 8260B and 8270C

TABLE 3-5

ACCURACY CONTROL LIMITS (%R)[1]
SURROGATE SPIKES
VOLATILE AND SEMIVOLATILE ORGANIC ANALYSIS[2]
NAS-WHITING FIELD, MILTON, FLORIDA

Chemical	Aqueous Samples	Solid Samples
VOLATILE ORGANICS		
Toluene-d8	NA	84-138
Bromofluorobenzene	NA	59-113
1,2-Dichloroethane-d4	NA	70-121
SEMIVOLATILE ORGANICS		
Nitrobenzene-d5	35-114	23-120
2-Fluorobiphenyl	43-116	30-115
Terphenyl-d14	33-141	18-137
Phenol-d5	10-110	24-113
2-Fluorophenol	21-110	24-121
2,4,6-Tribromophenol	10-123	19-122
2-Chlorophenol-d4	33-110(3)	20-130(3)
1,2-Dichlorobenzene-d4	16-110(3)	20-130(3)
PESTICIDES		
Tetrachloro-m-xylene	60-150	60-150
Decachlorobiphenyl	60-150	60-150

1 %R - Percent Recovery as described in Section 12.0.
2 USEPA Method SW-846 Method 8260B and 8270C
3 Advisory limits only.

TABLE 3-6

ACCURACY CONTROL LIMITS (%R)(1)
MATRIX SPIKE SAMPLES
METALS ANALYSIS2)
NAS-WHITING FIELD, MILTON, FLORIDA

Chemical	Aqueous Samples	Solid Samples
METALS		
Aluminum	75-125	NS(3)
Antimony	75-125	75-125
Arsenic	75-125	75-125
Barium	75-125	75-125
Beryllium	75-125	75-125
Cadmium	75-125	75-125
Calcium	NS	NS
Chromium (total)	75-125	75-125
Cobalt	75-125	75-125
Copper	75-125	75-125
Iron	75-125	NS
Lead	75-125	75-125
Magnesium	NS	NS
Manganese	75-125	75-125
Mercury	75-125	75-125
Nickel	75-125	75-125
Potassium	NS	NS
Selenium	75-125	75-125
Silver	75-125	75-125
Sodium	NS	NS
Thallium	75-125	75-125
Tin	75-125	75-125
Vanadium	75-125	75-125
Zinc	75-125	75-125

1 %R - Percent Recovery as described in Section 12.0.
2 USEPA Method 6010B

TABLE 3-7

ACCURACY CONTROL LIMITS (%R)[1]
LABORATORY CONTROL SAMPLES
METALS ANALYSIS[2]
NAS-WHITING FIELD, MILTON, FLORIDA

Chemical	Aqueous Samples	Solid Samples
Aluminum	80-120	TBD
Antimony	80-120(3)	TBD
Arsenic	80-120	TBD
Barium	80-120	TBD
Beryllium	80-120	TBD
Cadmium	80-120	TBD
Calcium	80-120	TBD
Chromium	80-120	TBD
Cobalt	80-120	TBD
Copper	80-120	TBD
Iron	80-120	TBD
Lead	80-120	TBD
Magnesium	80-120	TBD
Manganese	80-120	TBD
Mercury	NA	TBD
Nickel	80-120	TBD
Potassium	80-120	TBD
Selenium	80-120	TBD
Silver	80-120(3)	TBD
Sodium	80-120	TBD
Thallium	80-120	TBD
Tin	80-120	TBD
Vanadium	80-120	TBD
Zinc	80-120	TBD

1 overy as described in Section 12.0.
2 USEPA Method 6010B
3 Advisory Limits

3.4 REPRESENTATIVENESS

3.4.1 Definition

Representativeness is an expression of the degree to which the data accurately and precisely depict the actual characteristics of a population or environmental condition existing at an individual sampling point. Use of standardized sampling, handling, analytical, and reporting procedures ensures that the final data accurately represent actual site conditions.

3.4.2 Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program. It will be satisfied by ensuring that the RI/FS SAP is followed and that proper sampling techniques are used. The sampling network for the NAS-Whiting Field RI/FS program was designed to provide data representative of site conditions. During development of this network, consideration was given to past waste disposal practices, existing analytical data, and physical setting and processes. The rationale of the sampling network is discussed in detail in Section 3 of the RI/FS Work Plan.

3.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory data is ensured by using the proper analytical procedures, meeting sample holding times, and analyzing and assessing duplicate samples.

3.5 COMPARABILITY

3.5.1 Definition

Comparability is defined as the confidence with which one data set can be compared to another (e.g., between sampling points; between sampling events). Comparability is achieved by using standardized sampling and analysis methods, and data reporting formats (including use of consistent units of measure). Additionally, consideration is given to seasonal conditions and other environmental variations that could influence data results.

3.5.2 Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the DMP is followed and that proper sampling techniques are used. It is also dependent on recording field measurements using the correct units. Field measurement units are further discussed in Section 9.1.1.

3.5.3 Measures to Ensure Comparability of Laboratory Data

Planned analytical data will be comparable when similar sampling and analytical methods are used and documented. Results will be reported in units that ensure comparability with previous data and with current state and Federal standards and guidelines. Laboratory measurement units are further discussed in Section 9.1.2.

3.6 LEVEL OF QUALITY CONTROL EFFORT

Trip blank, rinsate blank, method blank, field and laboratory duplicate, laboratory control, and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs.

External QC measures (i.e., field quality control samples) consist of field duplicates, trip blanks, and equipment rinsate blanks. Information gained from these analyses further characterizes the level of data quality obtained to support project goals. Each of these types of field quality control samples undergo the same preservation, analysis, and reporting procedures as the related environmental samples. Each type of field quality control sample is discussed below.

Field duplicates are either two samples collected independently at a sampling location (e.g., surface water), or a single sample homogenized and split into two portions. [When volatile organic compounds (VOCs) are to be analyzed, the VOC sample aliquots are containerized first to avoid loss of constituents, then the remaining sample matrix is homogenized.] Field duplicates are collected and analyzed for all chemical constituents to measure the precision of the sampling and analysis methods employed. The level of the QC effort will be one field duplicate for every 5 to 9 samples and then 10% of the number of additional investigative samples.

Trip blanks, consisting of analyze-free water, will be submitted to the laboratory to provide the means to assess the quality of the data resulting from the field sampling program. Trip blanks only pertain to samples collected for VOC analysis. Trip blanks are used to assess the potential for contamination of samples to be analyzed for VOCs by contaminant migration into sample containers during sample shipment and storage. Trip blanks are prepared by the laboratory prior to the sampling event, shipped to the site with the sample containers, and kept with the investigative samples throughout the sampling event. They are then packaged for shipment with other VOC samples and sent for analysis. There should be one trip blank included in each sample shipping container that contains samples for VOC analysis. At no time after trip blank preparation are their sample containers to be opened before they reach the laboratory. Trip blanks are further discussed in Section 9.0 of TtNUS' CompQAP.

Equipment rinsate blanks are obtained under representative field conditions by collecting the rinse water generated by running analyte-free water through sample collection equipment after decontamination and prior to use. At least one equipment blank will be collected per day, per matrix. If pre-cleaned, dedicated, or disposable sampling equipment is used, one rinsate blank per type of equipment used must be collected as a "batch blank." Rinsate blanks are analyzed for the same chemical constituents as the associated environmental samples. Equipment blanks are further discussed in Section 9.0 of TtNUS' CompQAP.

Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures. Laboratory duplicate samples are analyzed for inorganic parameters to check for sampling and analytical reproducibility. MSs provide information about the effect of the sample matrix on the digestion and measurement methodology. All MSs for organic analyses are performed in duplicate and, as previously defined, are referred to as MS/MSD samples.

MS/MSD samples are investigative samples. Aqueous MS/MSD samples must be collected at triple the volume for VOCs and extractable organics. One MS/MSD sample will be collected/designated for every 20 or fewer investigative samples per sample matrix (i.e., groundwater, surface water).

The level of QC effort for analytical testing will conform to the appropriate analytical methods, as specified in Tables 7.1 of this QAPP.

4.0 SAMPLING PROCEDURES

Field sampling procedures for the NAS-Whiting Field RI/FS program are discussed in TtNUS' CompQAP. In addition, the TtNUS' CompQAP and the RI/FS SAP addresses the following sampling procedures and field investigation tasks:

- Groundwater-level measurements - Section 4.2.5.4 TtNUS CompQAP
- Monitoring well purging - Section 4.2.5.5 TtNUS CompQAP
- Sample containers, preservatives, and volume requirements – Appendix C
- Field measurements - Section 7.5 TtNUS CompQAP
- Decontamination procedures - Section 4.1 TtNUS CompQAP
- Investigation derived waste – Appendix D RI/FS Work Plan
- Sample identification system - Section 3 RI/FS Work Plan
- Sample packaging and shipping procedures - Section 4.4.3.2 TtNUS CompQAP
- Field quality control samples - Section 9.1.1 TtNUS CompQAP
- Recordkeeping – TtNUS SOP SA-6.3 (Appendix B)

5.0 CUSTODY PROCEDURES

Custody is one of several factors which is necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files. Final evidence files, including all originals of laboratory reports and purge files, are maintained under document control in a secure area. A sample or evidence file is under custody if:

- the item is in the actual physical possession of an authorized person, or;
- the item is in view of the person after being in his or her possession, or;
- the item was placed in a secure area to prevent tampering; or
- the item is in a designated and identified secure area with access restricted to authorized personnel only.

The chain-of-custody (COC) report is a multi-part, standardized form used to summarize and document pertinent sample information, such as sample identification and type, matrix, date and time of collection, preservation, and requested analyses. Furthermore, through the sequential signatures of various sample custodians (e.g., sampler, airbill number, laboratory sample custodian), the COC report documents sample custody and tracking. A "Cradle-to-Grave" sample tracking will be employed. Custody procedures apply to all environmental and associated field quality control samples obtained as part of the data collection system.

5.1 FIELD CUSTODY PROCEDURES

The FOL (or designee) is responsible for the care and custody of the samples collected until they are relinquished to the analyzing laboratory or entrusted to a commercial overnight courier. COC reports are completed for each sample shipment. The reports are filled out in a legible manner, using waterproof ink, and are signed (and dated) by the sampler. Pertinent notes, such as whether the sample was field filtered, or whether the sample is suspected to be high in contaminant concentration, are also indicated on the COC report. Information similar to that contained in the COC report is also provided on the sample label, which is securely attached to the sample bottle. COC report forms and sample labels will be supplied by the laboratory subcontractor. In accordance with NFESC guidelines, samples for chemical constituent analysis must be sent (for next-day receipt) to the laboratory within 24-hours of collection.

Full details regarding sample COCs (including use of custody seals and sample shipment protocols) are contained in TtNUS Standard Operating Procedure (SOP) SA-6.1, which is provided as Appendix A. TtNUS SOP SA-6.3, also provided as Appendix B, discusses maintenance of site logbooks, site notebooks, and other field records. Additionally, each of the various sampling SOPs incorporated into this QAPP contain a section that addresses relevant sample documentation (i.e., completion of sample logsheets, etc.). All sample records are eventually docketed into the TtNUS project central file.

5.2 LABORATORY CUSTODY PROCEDURES

When samples are received by the laboratory subcontractor, the laboratory's sample custodian examines each cooler's custody seals to verify that they are intact and that the integrity of the environmental samples has been maintained. The sample custodian then signs the COC report. The custodian then opens the cooler and measures its internal temperature. The temperature reading is noted on the accompanying COC report. The sample custodian then examines the contents of the cooler. Sample container breakages or discrepancies between the COC report and sample label documentation are recorded. With the exception of samples for volatile analysis, the pH of chemically preserved samples is checked using Hydrion paper and recorded. All problems or discrepancies noted during this process are to be promptly reported to the TtNUS Project Manager. Inter-laboratory COC procedures and specific procedures for sample handling, storage, disbursement for analysis, and remnant disposal will be followed as specified by the subcontract laboratory's SOPs and/or QA Plan.

5.3 FINAL EVIDENCE FILES

The TtNUS central file will be the repository for all documents which constitute evidence relevant to sampling and analysis activities as described in this QAPP. TtNUS is the custodian of the evidence file and maintains the contents of these files, including all relevant records, reports, logs, field notebooks, photographs, subcontractor reports and data reviews in a secure, limited access location and under custody of the TtNUS facility manager. The control file will include at a minimum:

- field logbooks
- field data and data deliverables
- photographs
- drawings
- soil boring logs
- laboratory data deliverables
- data validation reports
- data assessment reports

- progress reports, QA reports, interim project reports, etc.
- all custody documentation (chain-of-custody forms, airbills, etc.)

Upon completion of the contract, all pertinent files will be relinquished to the custody of the United States Navy.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

All instrumentation used to perform chemical measurements must be properly calibrated prior to use in order to obtain valid and usable results. The requirement to properly calibrate instruments prior to use applies equally to field instruments as it does to fixed laboratory instruments. Field instrument calibration is discussed in Section 6.1. Laboratory instrument calibration is discussed in Section 6.2.

6.1 FIELD INSTRUMENT CALIBRATION

Field instrument calibration is discussed in Section 7.5 of TtNUS CompQAP.

6.2 LABORATORY INSTRUMENT CALIBRATION

Calibration procedures for a specific laboratory instrument will consist of initial calibration (generally 3 to 5 points), initial calibration verification (inorganic methods only), and continuing calibration verification. In all cases, the initial calibration will be verified using an independently prepared calibration verification solution. The frequency of calibration will be performed according to the requirements of the specific methods.

All standards used to calibrate analytical instruments must be obtained from the National Institute of Standards and Technology (NIST) or through a reliable commercial supplier with a proven record for quality standards. All commercially supplied standards must be traceable to NIST reference standards, where possible, and appropriate documentation will be obtained from the supplier. In cases where documentation is not available, the laboratory will analyze the standard and compare the results to an USEPA-supplied known or previous NIST-traceable standard.

The calibration procedures and frequencies used by the subcontract laboratory will comply with the applicable analytical method. Brief descriptions of calibration procedures for major instrument types follow.

6.2.1 <u>GC/MS Volatile Organic Compound Analyses</u>

For volatile organic compounds, the gas chromatograph/mass spectrometer (GC/MS) system will be tuned and calibrated in accordance with the appropriate analytical. A bromofluorobenzene (BFB) instrument performance check (tuning check) must be run prior to the initial and each continuing calibration and must meet all method-specified criteria before analysis may continue. Initial calibration is required before any samples are analyzed and must include a blank and a minimum of five different concentrations as specified in the method. A BFB tuning check and a continuing calibration check, including the mid-range standard and a blank, must be performed at the beginning of each 12-hour shift during which analyses are performed.

6.2.2 GC/MS Semivolatile Organic Compound Analyses

For semivolatile organic compounds, the GC/MS system will be tuned and calibrated in accordance with the appropriate analytical method. A decafluorotriphenyl phosphine (DFTPP) instrument performance check (tuning check) must be run prior to the initial and each continuing calibration and must meet all method-specified criteria before analysis may continue. Initial calibration is required before any samples are analyzed and must include a blank plus five different concentrations as specified in the method. A DFTPP tuning check and a continuing calibration check, including the mid-range standard and a blank, must be performed at the beginning of each 12-hour shift during which analyses are performed.

6.2.3 Metals Analyses

6.2.3.1 Inductively Coupled Argon Plasma (ICP) Analyses

Inductively coupled plasma (ICP) spectrometry systems will be calibrated for the analysis of metals in accordance with the appropriate analytical method. Initial calibration is required each day before any samples are analyzed and consists of a calibration blank and at least one standard. The standard must be within the demonstrated linear range of the instrument. The linear range is verified quarterly. Following initial calibration, an initial calibration verification sample (obtained from a different source than the solutions used for calibration), an initial calibration blank, and an interference check sample are analyzed. A continuing calibration verification sample and a continuing calibration blank are run every 2 hours or every 10 samples, whichever occurs first. A continuing calibration verification sample, a continuing calibration blank, and an interference check sample are also run after analysis of the last sample. The initial calibration verification standard, continuing calibration verification standard, and interference check sample each contain analytes of interest at different concentrations. In addition, a standard prepared at a concentration of two times the quantitation limit is analyzed at the beginning and end of each sample analysis run or a minimum of twice per 8-hour period. Linearity spanning the range of analysis is verified using this combination of standards. All calibration standards contain acids at the same concentrations as the sample digestates.

6.2.3.2 Atomic Absorption Analyses

Graphite furnace and cold vapor atomic absorption (GFAA and CVAA) analyses will be calibrated in accordance with the appropriate analytical method. Initial calibration is required each day before any samples are analyzed and consists of a calibration blank and at least three calibration standards (at least four standards for mercury) covering the range of concentrations of interest. The correlation coefficient of the regression of concentration versus response should be 0.995 or greater. Immediately following initial calibration, an initial calibration verification sample (obtained from a different source than the solutions used for calibration) and an initial calibration blank are analyzed. A continuing calibration verification sample and a continuing calibration blank are run every two hours or every ten samples, whichever occurs first. A continuing calibration verification sample and a continuing calibration blank are also run after analysis of the last sample.

6.2.4 Miscellaneous Parameters

Calibration and standardization requirements for the analysis of the remaining parameters will be performed as specified in the applicable analytical methods. Analytical methods are further discussed in Section 7.0 of this QAPP.

7.0 ANALYTICAL AND MEASUREMENT PROCEDURES

Samples will be subjected to field and laboratory parameter measurement as necessary based on the sample location under investigation. The analytical program for environmental samples collected at each anticipated location is provided in Section 3 of the RI/FS Work Plan.

Chemical/physical parameters to be measured using field instrumentation include; temperature, specific conductance, pH, turbidity, dissolved oxygen, and REDOX potential (groundwater samples only). In addition, ferrous iron will be measured for groundwater samples using a field test kit. Measurement of field parameters and calibration of field instruments are discussed in Section 7.5 of TtNUS' CompQAP.

The analytical laboratory responsible for the chemical analyses must NFESC-approved, will be certified by the Florida Department of Health – Division of Laboratory Certification for all analyses that are requested by TtNUS and will be required to have a current FDEP approved CompQAP.

All groundwater samples for low-concentration volatiles analysis will be analyzed in accordance with current SW-846 methods. All samples for organics and metals and Inorganics Analysis will be analyzed in accordance with current SW-846 methods. Table 7-1 provides a summary of the laboratory analytical methods for the NAS – Whiting Field RI/FS program.

A complete list of the target compounds/analytes, RQLs, RDLs, and estimated PQLs is provided in Section 1.3.2.2 of this QAPP. Data generated through use of the EPA method protocols will be reported to the RQL for organics analysis and the RDL for inorganics analysis. Analytes which are positively identified and which can be quantitated at concentrations below the RQL/RDL will be reported as specified in the appropriate analytical method. All environmental data generated through use of non-CLP methods will be reported to the analyte's PQL. An analyte's PQL is an expression of the method detection limit with consideration given to required adjustments to ensure that the precision and accuracy requirements of the method are attainable. The PQLs provided in the tables in Section 1.3.2.2 are estimated since these values may vary based on the laboratory.

Quantitation and detection limits will also be adjusted, as necessary, based on dilutions and sample volume.

TABLE 7-1

SUMMARY OF ORGANIC AND INORGANIC ANALYTICAL PROCEDURES
NAS – WHITING FIELD, MILTON, FLORIDA

Analytical Parameter	Analytical Method
Volatile Organics - Low Concentration	SW-846 8260 B
Semivolatile Organics	SW-846 8270 C
Pesticides/PCBs	SW-846 8081
TPH	SW-846 8015 M
Iron (total and dissolved)	SW-846 6010 B
Total Kjeldahl Nitrogen	USEPA 351.1
Nitrite	USEPA 353.2
Nitrate	USEPA 353.2
Sulfate	USEPA 375.4
Sulfide	USEPA 376.1
Methane	USEPA RSKSOP-175 [a]
Ammonia	USEPA 350.1

a = USEPA, R.S. Kerr Enviornemntal Laboratory, B.S. Newwell, Sample Preparation and Calculatins for Dissolved Gas Analysis in Water Samples Using A GC Headspace Equilibration Technique, Revision No. 0. August 1994.

8.0 INTERNAL QUALITY CONTROL CHECKS

Field-related QC checks were discussed in Section 3.0 of this QAPP and in Section 9.1.1 of TtNUS' CompQAP. This section provides additional information regarding internal quality control checks for the field and the laboratory.

8.1 FIELD QUALITY CONTROL CHECKS

QC procedures for field measurements will include calibrating the instruments as discussed in Section 7.5 of TtNUS' CompQAP. Assessment of field sampling precision and bias will be made by collection of field duplicates and rinsate blanks for laboratory analysis as discussed in Section 3.6 of this QAPP.

8.2 LABORATORY QUALITY CONTROL CHECKS

The subcontract laboratory will have a QC program that ensures the reliability and validity of the analyses performed at the laboratory. Internal quality control procedures for analyses will comply with the applicable analytical method requirements.

Several internal laboratory QC checks are briefly discussed in the remainder of this section.

Laboratory method blanks are prepared and analyzed in accordance with the analytical method employed to determine whether contaminants originating from laboratory sources have been introduced and have affected environmental sample analyses. A method blank generally consists of an aliquot of analyte-free water that is subjected to the same preparation and analysis procedures as the environmental samples undergoing analysis. With the exception of recognized volatile and semivolatile common laboratory contaminants (i.e., methylene chloride, acetone, 2-butanone, and phthalate esters) detected , method blanks must not contain levels of target analytes above the reported detection limits (above 2.5X the RQL for methylene chloride and above 5X the RQL for acetone, 2-butanone, and phthalate esters). Under no circumstances are laboratory method blank contaminant values subtracted from environmental sample analysis results.

Matrix spike analysis for organic fraction analyses is performed in duplicate as a measure of laboratory precision. For inorganic analyses, one matrix spike analysis and one **laboratory duplicate** analysis are performed for every 20 environmental sample analyses of like matrix. With the exception of VOC MSD analyses, laboratory duplicates are prepared by thoroughly mixing and splitting a sample aliquot into two portions and analyzing each portion following the same analytical procedures that are used for the environmental sample analyses. For VOC MSD analyses, a second sample aliquot is used for analysis in order to avoid VOC constituent loss through the homogenization process. The field crew provides extra volumes of sample matrices designated for laboratory quality control analyses, as required. As discussed in Section 3.0 of this QAPP, control limits for MS and laboratory duplicate analyses.

Surrogates are organic compounds (typically brominated, fluorinated, or isotopically labeled) which are similar in nature to the compounds of concern, and which are not likely to be present in environmental media. Surrogates are spiked into each sample, standard, and method blank prior to analysis, and are used only in organic chromatographic analysis procedures as a check of method effectiveness. As discussed in Section 3.0, surrogate recoveries are evaluated against control limits specified in the associated method, where applicable, or laboratory-derived control limits.

Laboratory control samples serve to monitor the overall performance of each step during the analysis, including the sample preparation. Laboratory control sample analysis will be performed for low-concentration volatiles, metals, and as required by the applicable analytical. Aqueous LCS results must fall within the control limits specified in the analytical method, where applicable, or established by the laboratory. Aqueous LCSs shall be analyzed utilizing the same sample preparations, analytical methods, and QA/QC procedures as employed for the samples.

Internal standard performance criteria ensure that volatile and semivolatile GC/MS analysis sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (- 50% to + 100%) from the associated 12-hour calibration standard (±40% for low-concentration volatile analysis). The retention time of the internal standards in samples and blanks must not vary by more than ±30 seconds from the retention time of the associated 12-hour calibration standard (±20 seconds for low-concentration volatile analysis).

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

This section describes the procedures to be used for data reduction, review, and reporting for NAS – Whiting Field RI/FS program. All data generated during the course of the RI/FS will be maintained in hardcopy format by TtNUS in the Naval Facilities Engineering Command Southern Division designated central files located in TtNUS' Pittsburgh office.

In addition to the central files, photocopies of all hardcopy data (as well as electronic data) will be maintained in the Chemistry/Toxicology/Risk Assessment Department database records files located in TtNUS' Pittsburgh, Pennsylvania office. Upon completion of the contract, all files will be relinquished to the Navy.

9.1 DATA REDUCTION

Data reduction will be completed for both field measurements and laboratory-generated analytical data. Field data reduction will be relatively limited versus the degree of laboratory data reduction required for the project. Reduction of both field data and laboratory data are discussed in the remainder of this section.

9.1.1 Field Data Reduction

Field data will be generated through on-site water quality testing for general indicator parameters including pH, specific conductance, turbidity, and temperature, and through the use of field instruments or field test kits for measurement of additional parameters including REDOX potential, dissolved oxygen, and ferrous iron.

The field parameters will be recorded in the site logbook and on sample logsheets immediately after the measurements are taken and later encoded in the NAS – Whiting Field data base for presentation in the Report. If an error is made in the logbook, the error will be legibly crossed out (single-line strikeout), initialed and dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. No calculations will be necessary to reduce these data for inclusion in Report. Field data will be entered in the electronic data base manually, and the entries will be verified by an independent reviewer to make sure that no "transcription" errors occurred.

Field measurements will be recorded and reported in the following units:

- Hydronium ion concentration (standard pH units)
- Temperature (degrees Celsius)
- Specific Conductance (millimhos)
- Turbidity (Nephelometric turbidity units)
- Dissolved oxygen (mg/L)
- Ferrous iron (mg/L)
- REDOX Potential (mV)

Standard pH units as specified above is the negative logarithm (base 10) of the hydronium ion concentration in moles/liter.

9.1.2 Laboratory Data Reduction

Laboratory data reduction of analytical results generated via non-CLP methods will be completed in accordance with the applicable analytical methods.

Laboratory analytical data will be reported using standard concentration units to ensure comparability with regulatory standards/guidelines and previous analytical results. Reporting units for aqueous matrices for the classes of chemicals under consideration are as follows:

Groundwater samples:

- Volatile and semivolatile organics - µg/L
- Metals - µg/L
- Nitrite, nitrate, sulfate, sulfide, TKN, and ammonia - mg/L

Field Quality Control sample results will be included in the database for the NAS – Whiting Field RI/FS program. Specifically, the analytical results for field duplicates, trip blanks, and rinsate blanks will be provided. The results for field QC samples will be considered during the course of data review (in concert with laboratory method blanks) to eliminate false positive results according to the 5- and 10-times rules specified in the National Functional Guidelines for Organic and Inorganic Data Review. The results for laboratory QC samples such as method blanks will not be presented in the Report database. In addition, only the original (unspiked) sample results for MS/MSD samples will be provided in the database.

9.2 DATA VALIDATION

Validation of field measurements and laboratory analytical data are discussed in this section. Validation of field data will be limited to real time "reality" checks whereas laboratory analytical data will be reviewed. Review of laboratory analytical data is discussed in Section 9.2.2.

9.2.1 Field Measurement Data Validation

Field measurements will not be subjected to a formal data validation process. However, field technicians will ensure that the equipment used for field measurement is performing accurately via calibration as discussed in Section 7.5 of TtNUS' CompQAP. As described in Section 9.1.1, all field data entered into the electronic database will be independently reviewed for transcription errors.

9.2.2 Laboratory Data Validation

One hundred percent of the laboratory data will be validated. Validation of analytical data will be completed by the TtNUS Chemistry Department located in TtNUS' Pittsburgh, Pennsylvania office. Final review and approval of validated deliverables will be completed by the Department's Data Validation Coordinator.

Data validation will be completed to ensure that the data are of evidentiary quality. Particular emphasis will be placed on holding time compliance, spike recoveries, and blank results. The inorganic data will be validated in accordance with USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review and organic data will be validated in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. The analytical results for non-CLP parameters will be reviewed versus the applicable analytical methods.

9.3 DATA REPORTING

9.3.1 Field Measurement Data Reporting

Field data will be reported in the units discussed in Section 9.1.1. The Report will include a comprehensive database including all field measurements (specifically pH, specific conductance, temperature, turbidity, dissolved oxygen, REDOX potential, and ferrous iron). Field measurements will be transferred from the site logbook or sample logsheets to the electronic database manually and will be reviewed for accuracy by an independent reviewer. Transcription of field measurements to the electronic database will be completed shortly after completion of the field investigation and prior to receipt of laboratory analytical data.

All records regarding field measurements (i.e., field logbooks, sampling logbooks, and sample logsheets) will be placed in TtNUS' Southern Division central files upon completion of the field effort. Entry of these results in the data base will require removal of these results from the files. Outcards will be used to document the removal of any such documentation from the files (date, person, subject matter). Field measurement data will be reported in an appendix of the Report at a minimum and may also be reported in summary fashion if they are indicative of the presence of contamination (e.g., high specific conductance readings).

9.3.2 Laboratory Data Reporting

Data reported by the laboratory will be in accordance with the CLP reporting format and as further described in TtNUS' analytical Statement of Work for the contracted laboratory. All pertinent quality control data including method blanks, standards analysis, calibration information, etc., will be provided for the non-CLP analyses. Case narratives will be provided for each Sample Delivery Group.

All environmental and field QC sample results (trip blanks, field duplicates, rinsate blanks) will be included in the Report as an appendix. The database will include pertinent sampling information such as sample number, sampling date, general location, depth, and survey coordinates (if applicable). Sample-specific detection limits will be reported for nondetected analytes. Units will be clearly summarized in the data base and will conform to those identified in Section 9.1.2. The analytical data may also be reported in summary fashion within the body of the Report text in tabular and graphic fashion.

Data will be handled electronically pursuant to the electronic deliverable requirements specified in TtNUS' Basic Ordering Agreement with analytical laboratories. This agreement requires the analytical laboratories to provide data in both hardcopy and electronic form. The original electronic diskettes and the original hardcopy analytical data are maintained in TtNUS' Southern Division central files as received.

Data validation will be completed using the hard copy data. Upon completion of validation of a Sample Delivery Group and review by the Data Validation Coordinator, review qualifiers will be entered in the electronic data base and will be subjected to independent review for accuracy. During this review process, the electronic data base printout will also be contrasted with the hard copy data to ensure that the hard copy data and electronic data are consistent.

In addition, a summary of the data validation qualifiers for all project samples will be prepared. This summary will include a list of chemicals identified as laboratory and/or field QC blank contaminants, holding time exceedences, samples exhibiting field duplicate/replicate imprecision as well as affected chemicals, rejected results and associated specific causes, and general causes of estimated results. This summary will facilitate the preparation of a summary of the data review results and completeness assessment for inclusion in the Report.

10.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits will be performed periodically to ensure that work is being implemented in accordance with the approved Project Plans and in an overall satisfactory manner. Such audits will be performed by various personnel and will include evaluation of field, laboratory, data review, and data reporting processes. Examples of pertinent audits are as follows:

- The FOL will supervise and check daily that the field measurements are made accurately, equipment is thoroughly decontaminated, samples are collected and handled properly, and fieldwork is documented accurately and neatly.

- Performance and system audits of the laboratory will be performed regularly by a Navy Contractor (internal), and in accordance with the Laboratory Quality Assurance Plan (internal).

- Data validators will review (on a timely basis) the chemical analytical data packages submitted by the laboratory. The data validators will check that the data were obtained through use of an approved methodology, that the appropriate level of QC effort and reporting was conducted, and whether or not the results are in conformance with QC criteria. On the basis of these factors, the data validator will generate a report describing data limitations, which will be reviewed internally by the Data Validation Coordinator prior to submittal to the Project Manager.

- A formal audit of the field sampling procedures may be conducted by the TtNUS Quality Assurance Manager (QAM) or designee in addition to the auditing that is an inherent part of the daily project activities. The purpose of this audit is to ensure that sample collection, handling, and shipping protocols, as well as equipment decontamination and field documentation procedures, are being performed in accordance with the approved Project Plans and SOPs.

- A sample tracking system will be employed for all environmental samples. This system will allow for early detection of errors made in the field or by the laboratory so that necessary adjustments can be made while the field crew is mobilized.

- The Project Manager will maintain contact with the FOL and Data Validation Coordinator to ensure that management of the acquired data proceeds in an organized and expeditious manner. Similarly, the Project Manager will interface with the Modeling Coordinators, as applicable.

11.0 PREVENTIVE MAINTENANCE PROCEDURES

Measuring equipment used in environmental monitoring or analysis for the NAS – Whiting Field RI/FS program shall be maintained in accordance with the manufacturer's operation and maintenance manuals. Equipment and instruments shall be calibrated in accordance with the procedures, and at the frequency, discussed in Section 6.0 (Calibration Procedures and Frequency). Preventive maintenance for field and laboratory equipment is discussed in the remainder of this section.

11.1 FIELD EQUIPMENT PREVENTIVE MAINTENANCE

TtNUS has established a program for the maintenance of field equipment to ensure the availability of equipment in good working order when and where it is needed. This program consists of the following elements:

- The TtNUS equipment manager keeps an inventory of the equipment in terms of items (model and serial number), quantity, and condition. Each item of equipment is signed out when in use, and its operating condition and cleanliness checked upon return.

- The equipment manager conducts routine checks on the status of equipment and is responsible for the stocking of spare parts and equipment readiness. The equipment manager also maintains the equipment manual library.

- The FOL is responsible for working with the equipment manager to make sure that the equipment is tested, cleaned, charged, and calibrated in accordance with the manufacturer's instructions and TtNUS SOPs before being taken to the job site and during field activities.

- During calibration, an appropriate maintenance check is performed on each piece of equipment. Any problems encountered while operating the instrument will be recorded in the field log book including a description of the symptoms and corrective actions taken.

- If problem equipment is detected or should require service, the equipment should be logged, tagged, and segregated from equipment in proper working order. Use of the instrument will not be resumed until the problem is resolved.

11.2 LABORATORY INSTRUMENT PREVENTIVE MAINTENANCE

Proper maintenance of laboratory instruments and equipment is essential to ensuring their readiness when needed. Dependent on manufacturer's recommendations, maintenance intervals are established for each instrument. All instruments must be labeled with a model number and serial number, and a maintenance logbook must be maintained for each instrument. Personnel must be alert to the maintenance status of the equipment they are using at all times.

11.2.1 Major Instruments

Table 11-1 provides a summary of preventive maintenance procedures typically performed for key analytical instruments. Maintenance of key instruments is sometimes covered under service contracts with external firms. These contracts provide for periodic routine maintenance to help guard against unexpected instrument downtime. The contracts also provide for quick response for unscheduled service calls when malfunctions are observed by the operator.

The use of manufacturer recommended grades or better of supporting supplies and reagents is also a form of preventive maintenance. For example, gases used in the various gas chromatographs and metals instruments should be of sufficient grade to minimize fouling of the instrument. The routine use of septa, chromatographic columns, ferrules, AA furnace tubes, and other supporting supplies from reputable manufacturers will assist in averting unnecessary periods of instrument downtime.

11.2.2 Refrigerators/Ovens

The temperatures of refrigerators used for sample storage and drying ovens will be monitored a minimum of once daily. The acceptable range for refrigerator temperatures is 4°C ±2°C. Required temperatures of ovens will vary based on the analytical methods for which the ovens are used. The temperatures will be recorded on temperature logs. The logs will contain the following information at a minimum:

- Date
- Temperature
- Initials of person performing the check

Maintenance of the logs is typically the responsibility of the sample custodian. However, assignment of responsibilities for temperature monitoring to specific personnel does not preclude the participation of other laboratory personnel. If unusual temperature fluctuations are noted, it is the responsibility of the observer to immediately notify the person in charge of the discrepancy before the condition of the samples is compromised.

Unstable or fluctuating temperatures may be indicative of malfunctions in the cooling or heating system. On the other hand, the instability may be due to frequent opening of the door. Regardless of the cause, such an observation must be investigated, and modifications must be made to access procedures or repairs to equipment must be made to prevent jeopardizing the integrity of the samples.

TABLE 11-1

TYPICAL PREVENTIVE MAINTENANCE FOR KEY ANALYTICAL INSTRUMENTS
NAS – WHITING FIELD, MILTON, FLORIDA

Instrument	Preventive Maintenance	Maintenance Frequency
GC/MS	Volatiles: Bake oven, replace septum, check carrier gas.	As required.
	Semivolatiles: Replace the septum, clean injection port, replace liner, bake oven, check carrier gas, clean the source.	As required.
	Replace solvent washes and clean syringe.	Daily.
GC	Replace solvent washes and clean syringe.	Daily.
	Clip column, clean injection port, replace liner, and bake oven.	As required.
ICP	Change sample introduction tubing, clean nebulizer, clean spray chamber, clean torch, manual profile, and automatic profile optics.	As required.
GFAA	Clean contact cylinders, replace/clean tube, check lamp alignment.	As required.
CVAA	Change sample introduction tubing, change drying cell, re-zero detector.	As required.
Spectrophotometer	Check that cuvette has no scratch on its surface.	Daily.
	Turn power off at the end of the day and warm up for at least one hour before use.	Daily
TOC Analyzer	Refresh phosphoric acid.	Biweekly.
	Clean catalyst.	As required.
	Replace water in IC chamber.	Biweekly.

12.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

Compliance with the QC objectives outlined in Section 3.0 will be monitored via two separate mechanisms. Precision and accuracy will be assessed through data. Compliance with the completeness objectives for field and laboratory data/measurement will be calculated by hand (field measurements) and electronically via a database subroutine (laboratory data). Information necessary to complete the precision and accuracy calculations will be provided in electronic and hardcopy form by the subcontract laboratory. Equations to be used for the precision, accuracy, and completeness assessment are outlined in the remainder of this section.

12.1 ACCURACY ASSESSMENT

To assure the accuracy of the analytical procedures, a minimum of 1 of every 20 samples is spiked with a known amount of the analyte or analytes to be evaluated. The spiked sample is then analyzed. The increase in concentration of the analyte observed in the spiked sample, because of the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample determines the percent recovery. Control charts are plotted for each commonly analyzed compound and kept on matrix-specific and analyte-specific bases. The %R for a spiked sample is calculated according to the following formula:

$$\%R = \frac{\text{Amount in Spiked Sample} - \text{Amount in Sample}}{\text{Known Amount Added}} \text{ X } 100\,\%$$

12.2 PRECISION ASSESSMENT

Duplicate samples (for inorganic analyses) and MSD samples (for organic analyses) are prepared and analyzed at a minimum frequency of 1 per every 20 environmental samples. Duplicate samples are prepared by dividing an environmental sample into equal aliquots.

MSD samples are prepared by dividing an environmental sample into equal aliquots and then spiking each of the aliquots with a known amount of analyte. The duplicate samples are then included in the analytical sample set. The splitting of the sample allows the analyst to determine the precision of the preparation and analytical techniques associated with the duplicate samples. The RPD between the sample (or spike) and duplicate (or duplicate spike) is calculated and plotted. The RPD is calculated according to the following formula:

$$RPD = \frac{\text{Amount in Sample} - \text{Amount in Duplicate}}{0.5\ (\text{Amount in Sample} + \text{Amount in Duplicate})} \text{ X } 100\ \%$$

12.3 COMPLETENESS ASSESSMENT

Completeness is the ratio of the number of valid sample results to the total number of sample results expected to be obtained for the project as a whole. Following the completion of the analytical testing and data validation, the percent completeness will be calculated by the following equation:

$$\text{Completeness} = \frac{(\text{number of valid measurements})}{(\text{number of measurements planned})} \text{ X } 100\ \%$$

The results of the data validation process and the completeness assessment will be summarized in the Report using the summary format discussed in Section 9.3.2 and an electronic database subroutine.

13.0 CORRECTIVE ACTION

Under TtNUS' QA/QC program, it is required that any and all personnel noting conditions adverse to quality report these conditions immediately to the Project Manager and QAM. These parties, in turn, are charged with performing root-cause analyses and implementing appropriate corrective action in a timely manner. It is ultimately the responsibility of the QAM to document all findings and corrective actions taken and to monitor the effectiveness of the corrective measures performed.

13.1 FIELD CORRECTIVE ACTION

Field nonconformances or conditions adverse to quality must be identified and corrected as quickly as possible so that work integrity or quality of product is not compromised. The need for corrective action may arise based on deviations from Project Plans and procedures, adverse field conditions, or other unforeseen circumstances. Corrective action needs may become apparent during the performance of daily work tasks or as a consequence of internal or external field audits.

Corrective action may include resampling and may involve amending previously approved field procedures. If warranted by the severity of the problem (e.g., if a change in the approved Project Plan documents or SOPs is required), the Navy will be notified in writing via a Field Task Modification Request (FTMR), and Navy (in conjunction with USEPA Region IV and FDEP) approvals will be obtained. The FOL is responsible for initiating FTMRs; an FTMR will be initiated for all deviations from the Project Plan documents, as applicable. An example of an FTMR is provided as Figure 13-1. Copies of all FTMRs will be maintained with the onsite project planning documents and will be placed in the final evidence file.

Minor modifications to field activities such as a slight offset of a boring location will be initiated at the discretion of the FOL, subject to onsite approval by NAS – Whiting Field personnel. Approval for major modifications (e.g., elimination of a sampling point) must be obtained via an FTMR.

FIGURE 13-1

TETRA TECH NUS, INC.
FIELD TASK MODIFICATION REQUEST FORM

____________________ Client Identification	____________________ Project Number	____________________ FTMR Number

To________________________________ Location__________________ Date________________

Description:

____
____
____
____

Reason for Change:

____
____
____
____

Recommended Disposition:

____
____
____
____

____
Field Operations Leader (Signature, if applicable) Date

Disposition:

____
____
____
____

____
Project Manager (Signature, if required) Date

____

Distribution:	
Program Manager	Others as required__________________________
Quality Assurance Officer	____
Project Manager	____
Field Operations Leader	____

13.2 LABORATORY CORRECTIVE ACTION

In general, laboratory corrective actions are warranted whenever an out-of-control event or potential out-of-control event is noted. The specific corrective action taken depends on the specific analysis and the nature of the event. Generally, the following occurrences alert laboratory personnel that corrective action may be necessary:

- QC data are outside established warning or control limits;
- Method blank analyses yield concentrations of target analytes above acceptable levels;
- Undesirable trends are detected in spike recoveries or in duplicate RPDs;
- There is an unexplained change in compound detection capability;
- Inquiries concerning data quality are received; and
- Deficiencies are detected by laboratory QA staff audits or from performance evaluation sample test results.

Corrective actions are typically documented for out-of-control situations on a corrective action form. Using a corrective action form, any employee may notify the QA/QC Officer of a problem. The QA/QC Officer generally initiates the corrective action by relating the problem to the appropriate Laboratory Manager and/or Internal Coordinator, who then investigates or assigns responsibility for investigating the problem and its cause. Once determined, an appropriate corrective action is approved by the QA/QC Officer. Its implementation is verified and documented on the corrective action form and is further documented through audits.

13.3 CORRECTIVE ACTION DURING DATA REVIEW AND DATA ASSESSMENT

The need for corrective action may become apparent during data review, interpretation, or presentation activities, or problems may be identified as a result of oversight findings. The performance of rework, instituting a change in work procedures, or providing additional/refresher training are possible corrective actions relevant to data evaluation activities. The Project Manager will be responsible for approving the implementation of corrective action.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

QA reports to management will be provided in three primary formats during the course of the NAS – Whiting Field RI/FS program. Data validation letter reports will be prepared on a Sample Delivery Group-specific basis and will summarize QA issues for the subcontract laboratory data. In addition, written weekly reports summarizing accomplishments and QA/QC issues during the field investigation will be provided by the FOL. Finally, monthly progress reports are provided by the Project Manager. In addition, a summary of data review qualifiers and a completeness assessment for all project samples will be included in the Report.

14.1 CONTENTS OF PROJECT QUALITY ASSURANCE REPORTS

The contents of the specific QA reports are as follows. The data validation reports address all major and minor laboratory noncompliances as well as noted sample matrix effects. In the event that major problems occur with the analytical laboratory (e.g., holding time exceedences or calibration noncompliances, etc.) the Data Validation Coordinator will notify the Project Manager, the Technical Program Manager, and the Laboratory Services Coordinator. Such notifications (if necessary) are typically provided via internal memoranda and are placed in the project file. Such reports contain a summary of the noncompliance, a synopsis of the impact on individual projects, and recommendations regarding corrective action and compensational adjustments. Corrective actions are initiated at the program level.

The FOL will provide the Project Manager with weekly reports regarding accomplishments, deviations from the DMP, upcoming activities, and a QA summary during the course of the field investigation. In addition, monthly project review meetings are held for all active Navy CLEAN III projects. Issues discussed at the project review meeting include all aspects of budget and schedule compliance, and QA/QC problems. The Project Manager provides a monthly progress report to the Navy which addresses the project budget, schedule, accomplishments, planned activities, required revisions of the QAPP, and QA/QC issues and intended corrective actions.

14.2 INDIVIDUALS RECEIVING/REVIEWING QUALITY ASSURANCE REPORTS

Data review QA Reports are provided to the Project Manager for inclusion in the project files. In the event that major problems are observed for a given laboratory, the Program Manager, Deputy Program Manager, QA Manager, Project Manager, and Laboratory Services Coordinator are provided with copies of the QA report. Weekly field progress reports are provided to the Project Manager. Monthly progress reports are provided to the Navy CLEAN III Program Manager and the Navy CLEAN III Contracting Officers Technical Representative.

APPENDIX G

UST CLOSURE ASSESSMENT AND DATA FROM USED OIL SITE

411- 00191

AUG 24 1998

Mr. Joseph Thayer
Santa Rosa County Petroleum Program
Escambia County Health Department
1196 West Leonard Street, Suite Two
Pensacola, Florida 32501-1116

SUBJECT: Bechtel Job No. 22567
Department of the Navy Contract No. N62467-93-D-0936
UST CLOSURE ASSESSMENT AND DATA FROM USED OIL SITE (SITE 29)
DELIVERY ORDER 042, NAS WHITING FIELD, FL
Subject code: 7560

Dear Mr. Thayer:

Enclosed is the UST Closure Assessment for the used oil UST FDEP FAC No. 578516386 that was removed from Site 29 at NAS Whiting Field, June 23, 1998. This tank had been previously abandoned in place, apparently before being included in the formal tank management program at this base.

The tank was located within the boundaries of Site 29, a site which is included in the U.S. Navy Installation Restoration (IR) Program for NAS Whiting Field. Site 29 will be further investigated as a part of the continuing IR Program at Whiting Field, and the resulting remedial actions performed at this site will address all remaining contaminants of concern.

Also included herewith is the data from a soil sample collected at the location of UST FDEP FAC No. 5788840639 for which you have received previous documentation dated March 10, 1997. This tank was also located within the boundaries of Site 29. The samples were collected from a depth of 10 feet below land surface, extending below the depth of the previous tank pit, but avoiding penetration of the shallow aquitard underlying this location. The area surrounding this tank is also included in the Site 29 IR investigation and remediation.

If you need any additional information concerning either of these sites please contact me at 423-220-2205.

Yours truly,

Thomas M. Conrad

Thomas M. Conrad
Project Manager

TMC:crh:Lr1687
Enclosures: As stated

RIDA

Florida Department of Environmental Protection

Twin Towers Office Bldg. ● 2600 Blair Stone Road ● Tallahassee, Florida 32399-2400

Form Title Closure Assessment Form
Effective Date December 10, 1996
Revised ______
DEP Application No. ______ (Filled in by DEP)

Closure Assessment Form

[C]opy of this form, the closure assessment and any attachments shall be submitted to the County withing 60 days of a permanent [cl]osure, replacement, installation of secondary containment, or change in service from a regulated substance to non-regulated sub[st]ance. This form shall be used to accompany the Closure Assessment Report, along with a detailed drawing or sketch of the facility [th]at includes the storage system location, monitoring wells, buildings, storm drains, sample locations, potable wells and dispenser [lo]cations.

Complete All Applicable Blanks
Please Print or Type

Date August 19, 1998 2. DEP Facility ID Number: 578516386 3. County Santa Rosa

Facility Name: NAS Whiting Field 5. Facility Owner: U.S. Navy

Facility Address: Bldg. 1404, Island Street, Milton, FL 32570

Mailing Address: Commanding Officer, NAS Whiting Field c/o Les Lassiter, 7550 Essex St., Suite 100, Milton, FL 32570-6155

Telephone Number: (850) 623-7181 9. Facility Operator: U.S. Navy

Are the Storage Tank(s): (Circle one or both) A. Aboveground or **(B. Underground)**

Type of Product(s) Stored: Used motor oil

Were the Tank Systems: (Circle one) A. Replaced **(B. Removed)** C. Closed in Place D. Upgraded E. Installed with Secondary Containment F. Changed to a Non-Regulated Substance

Number of Tanks closed: 1 14. Age of Tanks: Unknown

Facility Assessment Information

	Yes	No
[C]ontamination discovered on site that was not previously reported?	☐	☒
[I]f yes, was:		
a. A Discharge Report Form submitted to the county?	☐	☐
b. An investigation performed in accordance with Rule 62-761.820, F.A.C.?	☐	☐
[I]s the depth to ground water less than 20 feet?	☐	☒
[I]f yes, please include the results of ground water sampling and analysis in the Closure Assessment Report.		
[A]re there monitoring wells on site?	☒	☐
[I]f Yes, were they:		
a. groundwater wells?	☒	☐
b. vapor monitoring wells?	☐	☐
c. used for closure assessment sampling?	☐	☐
d. properly closed?	☐	☐
e. retained for contamination assessment purposes?	☒	☐
Are any potable wells located within 1/4 of a mile radius of the facility?	☐	☒
Is there a surface water body within 1/4 mile radius of the site? If yes, indicate distance: ______	☐	☒
A detailed drawing or sketch of the facility that includes the storage system location, monitoring wells, buildings, storm drains, sample locations, potable wells and dispenser locations must accompany this form.		
Was initial remediation action taken to clean up minor spills or contamination on site, such as contaminated soils removed from around the fill pipe?	☒	☐

Thomas M. Conrad — 8-24-98
Signature of Person Performing Assessment — Date

for U.S. Navy — 8-24-98
Signature of Owner — Date

PROJECT MGR, BECHTEL ENVIRONMENTAL
Title of Person Performing Assessment

Attachment 1

CLOSURE ASSESSMENT REPORT for SITE 29 UST REMOVAL NAS WHITING FIELD, MILTON, FL

Background Information

The UST at Site 29 was located at the edge of the parking lot between the Mechanical Hobby Shop, Building 2975, and the Hobby Shop, Building 1404, facilities (see Figure 1, Used Oil UST, Site 29). Prior to its abandonment in place in 1986, this UST was used for collecting used oil and related petroleum-based liquids from the auto repair and maintenance operations in the Mechanical Hobby Shop. These liquids probably included industrial cleaning solvents for parts washing and used crankcase oil from automobile engines. Because tetraethyl lead was a fuel additive at the time, traces of lead from the used oil accumulated in the sludge in the bottom of the tank, along with other metals from engine wear. There was no historical documentation available indicating the sludge was removed from the tank prior to the tank being partially filled with sand and abandoned in place in 1986.

As optional work (OW), the Navy requested a soil sample be collected from the area where an abandoned heating oil UST was previously removed near the Hobby Shop, Building 1404 (see Figure 2, Heating Oil UST, Site 29 OW). The data for this sampling activity is included with the data for this Closure Assessment.

Removal Activities

The abandoned UST at between Buildings 2975 and 1404 was removed by mechanically excavating approximately 2 ft of soil overlying the tank, and hand excavating soil around the tank to enable the tank to be lifted mechanically. The tank was opened to determine the amount of sand, and the presence of standing liquids. The tank was approximately half filled with sand, and only trace amounts of water were found. The tank was then mechanically lifted out of the excavated area and laid on clean plastic sheeting. Once the tank was removed the excavation was inspected for visible standing liquids, and staining which would indicate leakage from the tank. Only a very small amount of standing water was observed in the bottom of the excavation, and there was very little staining observed.

The excavation was enlarged to remove any visibly stained soil and standing liquids. This material and the soil removed from above the tank were placed into a 20 yd^3, plastic-lined roll-off for transport to the disposal facility. The tank was also placed into the roll-off with the excavated soils. There was no observable liquid remaining in the excavation.

Sampling Activities

Used Oil UST, Site 29

After the excavation was completed, soil samples were collected for offsite laboratory analysis. One sample was collected from each of the four sidewalls of the excavation and one sample was collected from the bottom of the excavation. The depth of the sidewall samples was 4 ft

Attachment 1 (continued)

below land surface (bls) in the area of visible staining. The depth of the bottom sample was 7 ft bls. Figure 1, Used Oil UST, Site 29, shows the location of these samples.

Heating Oil UST, Site 29 OW

One sample was collected from beneath the concrete adjacent to Building 1404 at the site of a previously removed UST. The depth of the sample was 10 ft. Figure 2, Heating Oil UST, Site 29 OW, shows the location of this sample.

All samples were shipped to an offsite laboratory and received within 48 hours of collection. Samples were analyzed for the chemicals of concern listed in Section 62-770.600 (3) (f) of the Florida Administrative Code. Attachment 2 shows the analytical data requirements used for analysis, and Attachment 3 provides a table of analytical results from the sampling activities.

Groundwater

The excavation depth after removal of the tank and visibly stained soil from the bottom of the hole was 7 ft. Because there was no standing water, and it was previously agreed with Escambia County compliance personnel to not penetrate the aquitard known to exist locally at approximately that depth, no monitoring well was installed at the tank location. A nearby monitoring well (see Figure 1) was measured to determine depth to water. The well was dry to a depth of 100 ft.

Attachment 2

NAS Whiting Field Underground Storage Tank (UST) Removal at Site 29
Comparison of Confirmation Sampling Data to State of Florida Soil Cleanup Target Levels
(Table IV, 62-770.680, September 23, 1997)[1]

Chemicals of Concern (Organic)	Direct Exposure (mg/kg) II ##[2]	Leachability (mg/kg) based on: Table V[3]	Sample No. WF14001 (South Wall)	Sample No. WF14002 (West Wall)	Sample No. WF14003 (North Wall)	Sample No. WF14004 (East Wall)	Sample No. WF14005 (Bottom)	Sample No. WF14006[3]	Sample No. WF14007[3,4]
PAHs:									
Acenapthene	22,000	4							
Acenapthylene	11,000	22							
Anthracene	29,000	2000							
Benzo (a) anthracene	5.1	2.9							
Benzo (a) pyrene	0.5	7.8							
Benzo (b) fluoranthene	5.0	9.8							
Benzo (g,h,i) perylene	45,000	13000							
Benzo (k) fluoranthene	52	25							
Chrysene	490	80							
Dibenz (a,h) anthracene	0.5	14							
Fluroanthene	45,000	550							
Fluorene	24,000	87							
Indeno (1,2,3-c,d) pyrene	5.2	28							
Naphthalene	40 8,600 276	1 1.7			2.60	2.50			
Phenanthrene	29,000	120							
Pyrene	40,000	570							
VOAs:									
Benzene	1.1 1.5 1.6	0.007 ✓	.006	.007	.028	.016	.006 J	.013	.008 J
Ethylbenzene*	240	0.4			1.00		.020		
Toluene	2,000	0.4			.086	0.62	0.18	.050	.055
Total Xylenes**	290	0.3	.006	.011	4.40	2.6	.091	.008 J	.008 J
OTHER									
1,2-dichloroethane	0.9	0.02							
MTBE	6,100	0.2							
TRPHs	2,500	340		1,500	14,000	5,800	850	40	

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Attachment 2 (continued)

NAS Whiting Field Underground Storage Tank (UST) Removal at Site 29
Comparison of Confirmation Sampling Data to State of Florida Soil Cleanup Target Levels
(Table IV, 62-770.680, F. A. C., September 23, 1997)[1]

Chemicals of Concern (Organic)	Direct Exposure (mg/kg) II ##[2]	Leachability (mg/kg) based on: Table V[2]	Sample No. WF14001 (South Wall)	Sample No. WF14002 (West Wall)	Sample No. WF14003 (North Wall)	Sample No. WF14004 (East Wall)	Sample No. WF14005 (Bottom)	Sample No. WF14006[3]	Sample No. WF14007[3,4]
METALS:									
Arsenic	3.7	TCLP (5.0)							
Barium	87,000	TCLP (100)	11.0	11.0	16.0	16.0	14.0	30.0	35.0
Cadmium	1,300	TCLP (1.0)							
Chromium	430	TCLP (5.0)	7.4	7.6	18.0	24.0	18.0	19.0	24.0
Lead***	1,000	TCLP (5.0)		22.0	7.0	8.0	21.0	38.0	23.0
Mercury	28	TCLP (0.2)							
Selenium	10,000	TCLP (1.0)							
Silver	9,100	TCLP (5.0)							

Notes:

1. Table IV taken from September 23, 1997, version of 62-770.680, Florida Administrative Code, *Petroleum Contamination Site Cleanup Criteria*, September 23, 1997. ## = values based on industrial exposure assumptions. Data from confirmation samples is presented in mg/kg for comparison purposes. Shaded areas of table indicate samples which exceed either Direct Exposure II# based on Table IV or Leachability based on Table V.

2. Cleanup criteria to be met when requesting "No Further Action" following UST removal. Analytical results from confirmation samples must not exceed the lower of these criteria.

3. Sample collected from site of previously removed heating oil UST #5788840639 at Building 1404 as part of optional work requested by the Navy.

4. Duplicate sample collected from site of previously removed heating oil UST #5788840639 at Building 1404.

* Unless the Method Detection Limit (MDL) using the most sensitive and currently available technology is higher than the specified criterion.

** Direct Exposure values based on Soil Saturation Limit (Csat).

*** Direct Exposure values from USEPA *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Correction Action Facilities*, OSWER Directive 9355.4-12 (1994). Residential value is the middle of the USEPA suggested range of 400-600 mg/kg.

Attachr 3

Analytical Data Requirements for Site 29

Soil Sampling

Sample Event	Analytical Method	DQO Level	Sample Volume	Sample Container	Preservative	Holding Time	QC Samples Required[1]
nfirmation Soil Samples							
ority pollutant volatile ganics	EPA 8260	III	Fill container	Glass, 2-oz. widemouth with teflon septum plus (2) 5-gram encore sampler plunger	Cool 4° C	14 days	TB: 1/cooler shipment DUP: 1/20 RB: 1/20 or weekly MS/MSD: 1/20
iority pollutant extractable ganics	EPA 8270	III	Fill container	Glass, 4-oz. widemouth with teflon-lined cap	Cool 4° C	14 days	DUP: 1/20 RB: 1/20 or weekly MS/MSD: 1/20
on-priority pollutant organics vith GC/MS peaks >10 µg/L)	EPA 8270						
RPHs	FL-PRO	III	Fill container	Glass, 4-oz. widemouth with teflon-lined cap	Cool 4° C	28 days	DUP: 1/20 RB: 1/20 or weekly MS/MSD: 1/20
CP Scan for Arsenic, Barium, admium, Lead, Selenium, ilver	6010	III	Fill container	Glass, 4-oz. widemouth with teflon-lined cap	Cool 4° C	6 months	DUP: 1/20 RB: 1/20 or weekly MS/MSD: 1/20
lercury	EPA 7471	III	Fill container	Place in same jar with ICP scan	Cool 4° C	28 days	DUP: 1/20 RB: 1/20 or weekly MS/MSD: 1/20

[1] Generic QC sample types will include the following: TB: Trip Blank, RB: Equipment Rinsate Blank, FB: Field Blank, Dup: Duplicate, MS/MSD: Matrix Spike/Matrix Spike Duplicate

#1 south wall 4' depth
#2 east wall 4' depth
#3 north wall 4' depth
#4 west wall 4' depth
#5 bottom of excavation 7' depth

Figure 1

USED OIL UST
SITE 29

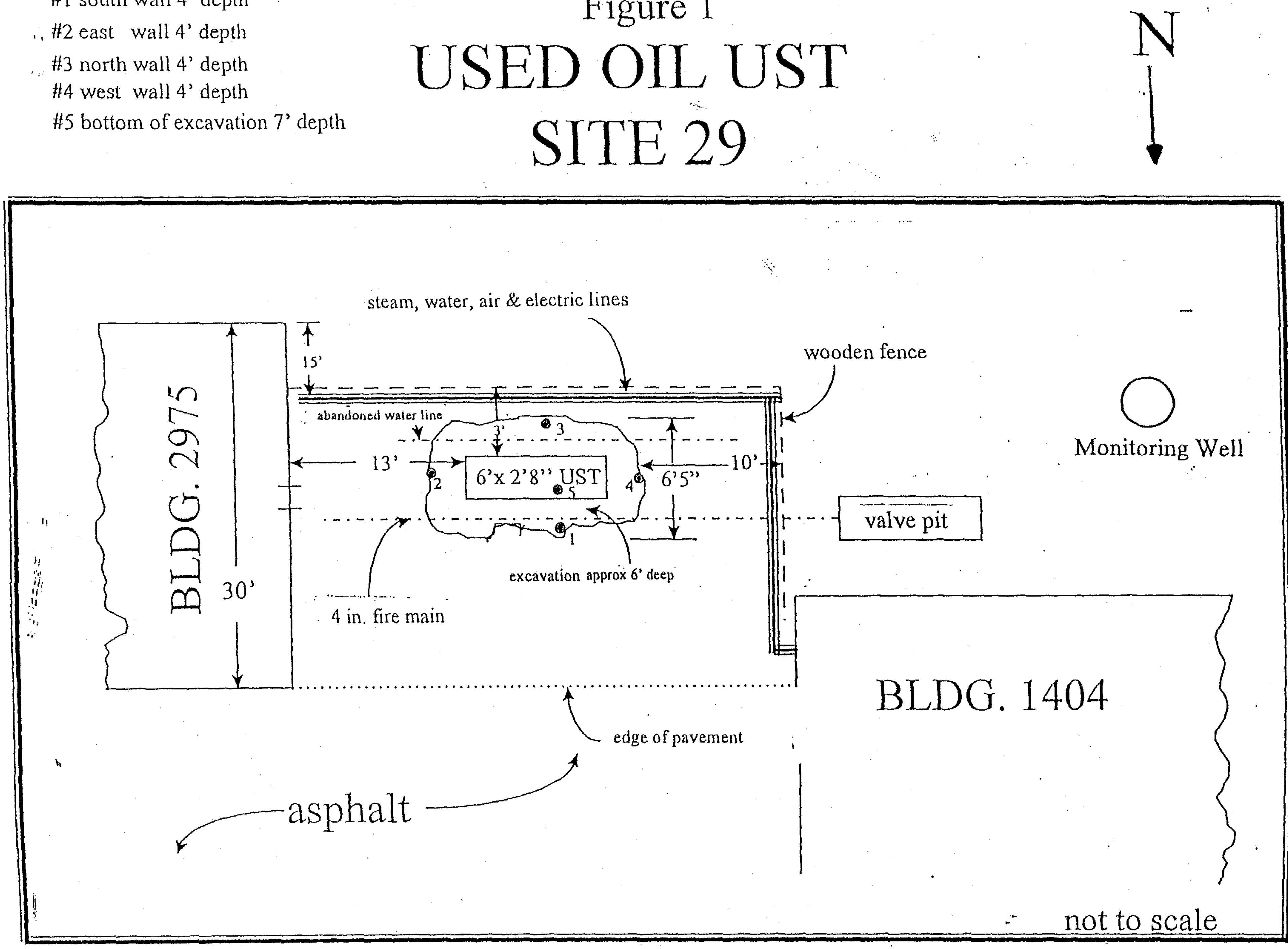

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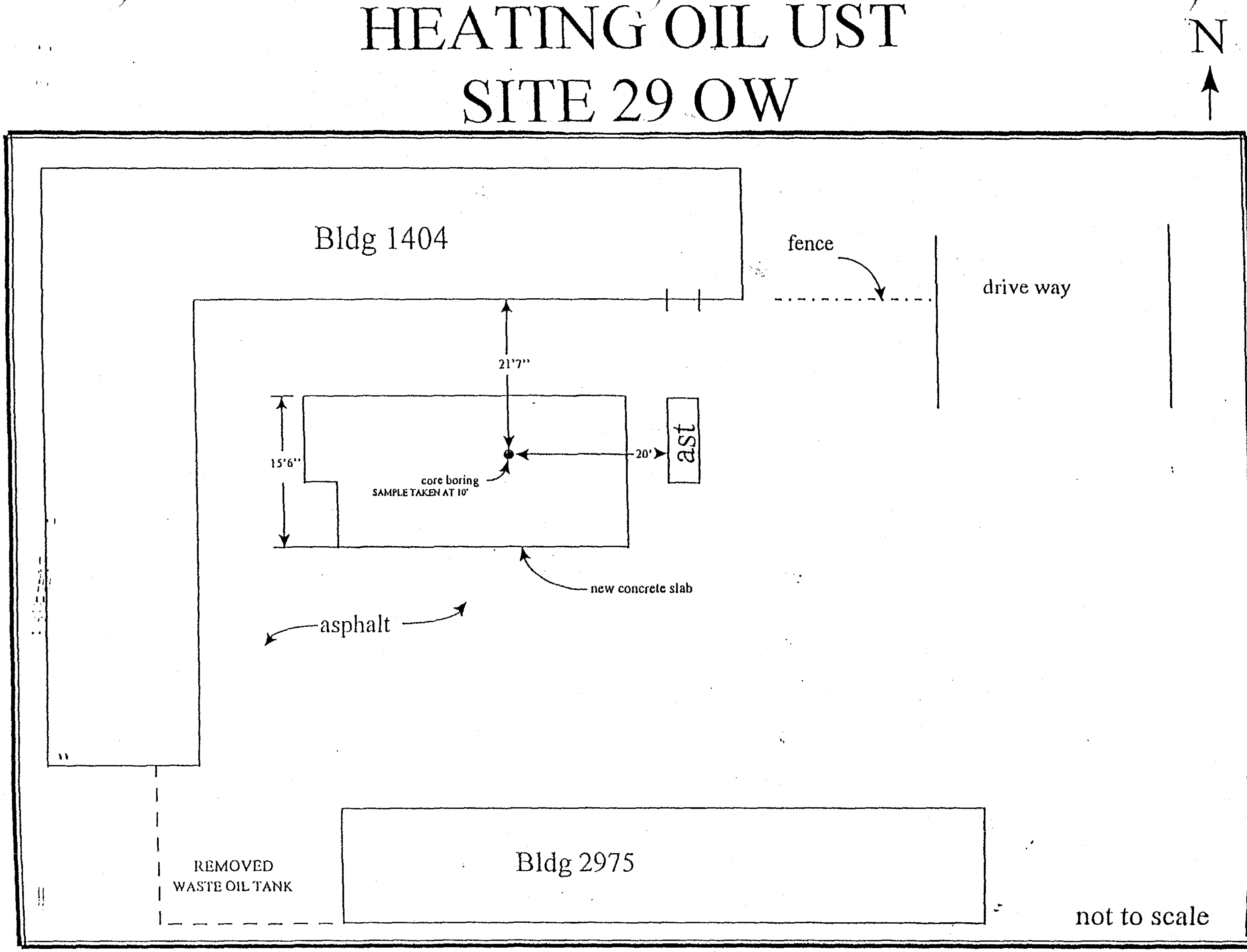
Figure 3

HEATING OIL UST
SITE 29 OW



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Bcc: Jim Holland, NAS Whiting Field
Linda Martin, SDiv